

This Page Is Inserted by IFW Operations  
and is not a part of the Official Record

## **BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning documents *will not* correct images,  
please do not report the images to the  
Image Problem Mailbox.**

JP 10-209512

## \* NOTICES \*

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

DETAILED DESCRIPTION

---

## [Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the peripheral-vision private seal equipment for vehicles using the camera and it which can picturize the direction of plurality simultaneously.

[0002]

[Description of the Prior Art] Drawing 11 is drawing showing operation of vehicles which carried the conventional peripheral-vision private seal equipment for vehicles to explain. Generally, when vehicles 15 tend to go into a crossing, the field shown to an operator with a slash at drawing 11 will become a dead angle 17. And an operator cannot check by looking other vehicles 16 which exist in the dead angle 17 of these right and left. Then, in order to make an operator check the situation of a dead angle 17 by looking, a camera 18 is attached in anterior part covering of vehicles, the dead angle 17 on either side is simultaneously photoed with this camera 18, and the peripheral-vision private seal equipment for vehicles which displays the picture of a dead angle 17 as shown in drawing 12 on the screen of a monitor TV 8 is put in practical use.

[0003] Below, an example of the conventional camera is explained based on drawing 13. Entrance windows 4a and 4b are formed in right and left, and the tank 4 as housing has come to be able to carry out incidence of the extraneous light on either side. And the image formation lens 3 is attached in a tank 4, and the image pck-up element 13 which consisted of CCD is arranged in the focal position of the image formation lens 3. Moreover, the 1st mirror 10a and 10b of a couple is arranged in right and left of the image formation lens 3. Furthermore, the 2nd mirror 11a and 11b of a couple faces the 1st mirror 10a and 10b of a couple, and is arranged.

[0004] Thus, through entrance window 4a, in a tank 4, incidence is carried out, it is first reflected by 1st mirror 10a, and, subsequently extraneous light 5a from the right (it sets to drawing 13 and is above) is reflected by 2nd mirror 11a in constituted camera 18A. Extraneous light 5a reflected by this 2nd mirror 11a is led to the image formation lens 3, and connects a handstand normal image to the left half of the image pck-up side of the image pck-up element 13. On the other hand, through entrance window 4b, in a tank 4, incidence is carried out, it is first reflected by 1st mirror 10b, and, subsequently extraneous light 5b from the left (it sets to drawing 13 and is down) is reflected by 2nd mirror 11b. Extraneous light 5b reflected by this 2nd mirror 11b is led to the image formation lens 3, and connects a handstand normal image to the right half of the image pck-up side of the image pck-up element 13. Then, when this camera 18A is applied to the circumference check-by-looking equipment for vehicles, the picture signal of the handstand normal image which received light with the image pck-up element 13 is displayed to become top-and-bottom reverse on the screen of a monitor TV. Then, as shown in drawing 12, the normal image according [ the normal image by extraneous light 5a from the right ] to extraneous light 5b from the left is displayed on right screen 8a of a monitor TV 8 by left screen 8b, respectively. And an operator can check now the situation of a dead angle on either side from the screen of a monitor TV.

[0005] In this camera 18A, the picture which turned into a mirror image by mirror 10a (10b) of

reflecting extraneous light 5a (5b) twice by the 1st and 2nd mirrors 10a and 11a (10b, 11b), i.e., the 1st, is made into the normal image by 2nd mirror 11a (11b). Here, when only 1st mirror 10a (10b) is used not using 2nd mirror 11a (11b), the picture which received light with the image pck-up element 13 turns into a handstand mirror image. In this case, the mirror image CCD which carries out right-and-left reversal and outputs a light-receiving signal as an image pck-up element 13 will be used. And the picture signal of the handstand mirror image which received light carries out right-and-left reversal, and is outputted from the image pck-up element 13 as a picture signal of a handstand normal image, and it is made to display on a monitor TV that it becomes top-and-bottom reverse. Then, as shown in drawing 14, the normal image according [ the normal image by extraneous light 5b from the left ] to extraneous light 5a from the right will be displayed on left screen 8b by right screen 8a of a monitor TV 8. Consequently, the direction of a screen display of a monitor TV will become contrary to the direction of incidence, and will become an operator with a screen hard to see.

[0006] Subsequently, other examples of the conventional camera are explained based on drawing 15. This camera 18B is replaced with a reflective mirror, and is constituted like above-mentioned camera 18A except for the point using a mirror image CCD as an image pck-up element 13 using prism. That is, the prism 6a and 6b of a couple is installed up and down in the image formation lens 3 by the preceding paragraph of the image formation lens 3 side by side on both sides of a medial axis.

[0007] Thus, incidence of the extraneous light 5a from the right (it sets to drawing 15 and is the right) is carried out into a tank 4 through entrance window 4a, and it carries out incidence to prism 6a, it is reflected by reflector 7a, and it is led to the image formation lens 3, and connects a handstand mirror image with constituted camera 18B to the lower half of the image pck-up side of the image pck-up element 13. On the other hand, incidence is carried out into a tank 4 through entrance window 4b, incidence is carried out to prism 6b, it is reflected by reflector 7b, and extraneous light 5b from the left (it sets to drawing 15 and is the left) is led to the image formation lens 3, and connects a handstand mirror image to the upper half of the image pck-up side of the image pck-up element 13. In this camera 18B, since reflection is 1 time, although a miniaturization can be attained, the picture by which image formation is carried out to the image pck-up element 13 will turn into a mirror image. Then, when this camera 18B is applied to the circumference check-by-looking equipment for vehicles, right-and-left reversal is carried out, and the picture signal of the handstand mirror image which received light with the image pck-up element 13 is outputted from the image pck-up element 13, and is displayed to become top-and-bottom reverse on the screen of a monitor TV. Then, as shown in drawing 16, the normal image according [ the normal image by extraneous light 5a from the right ] to extraneous light 5b from the left is displayed on upper screen 9a of a monitor TV 8 by lower screen 9b, respectively. And an operator can check now the situation of a dead angle on either side from the screen of a monitor TV.

[0008]

[Problem(s) to be Solved by the Invention] since camera 18A using the conventional reflective mirror is reflected twice by the 1st mirror and 2nd mirror as mentioned above -- the size of equipment -- \*\*\*\* -- the technical problem which it hears that it will become occurred On the other hand, camera 18B using two prism becomes a normal image according [ upper screen 9a of a monitor TV ] to extraneous light 5a from the right as mentioned above, and lower screen 9b becomes a normal image by extraneous light 5b from the left. Then, when this camera 18B was applied to the circumference check-by-looking equipment for vehicles, the technical problem that the screen displayed on a monitor TV will become an operator with a screen hard to see occurred. Moreover, two or more prism is need and the technical problem that low-cost-ization could not be attained also occurred:

[0009] This invention was made in order to solve the above technical problems, it makes reflection of light 1 time, attains simplification of composition and aims at obtaining a small and cheap camera. Moreover, a left screen is made to display the normal image according the normal image by the extraneous light from the right to the extraneous light from the left on the right screen of a monitor TV, and it aims at obtaining the circumference check-by-looking equipment for vehicles with which a legible picture is acquired by the operator.

[0010]

[Means for Solving the Problem] Housing with which the entrance window which, as for the camera concerning this invention, takes in an extraneous light on both sides, respectively was prepared, While reflecting once the extraneous light which carries out incidence from the image pck-up element arranged in this housing, and the entrance window of an unilateral and carrying out image formation of the handstand mirror image by this extraneous light to the field by the side of the entrance window of this unilateral of the image pck-up side of this image pck-up element The extraneous light which carries out incidence from the entrance window of the side else is reflected once, and the field by the side of the entrance window of the side other than [ this ] the image pck-up side of this image pck-up element is equipped with the optical element which carries out image formation of the handstand mirror image by this extraneous light.

[0011] Moreover, the above-mentioned optical element consists of an image formation lens which is arranged by the preceding paragraph of the above-mentioned image pck-up element, and carries out image formation of the extraneous light on the image pck-up side of this image pck-up element, and prism which the cross-section configuration was fabricated by the prism object of two equilateral triangles, and two bisectrices of the vertical angle of these two equilateral triangles were made in agreement with the optical axis of this image formation lens, and was arranged by the preceding paragraph of this image formation lens. Moreover, the field where the above-mentioned prism consists of bases of cross-section 2 equilateral triangle is formed in the lens side. Moreover, as for the above-mentioned prism, the vertical angle of cross-section 2 equilateral triangle is constituted by 60 degrees. Moreover, the above-mentioned prism has the refractive index  $N$  specified by the lower formula (3).  

$$60 \text{ degree} - \sin^{-1} \{ \sin(\theta/N) \} \geq \sin^{-1} (1/N) \text{ Formula (3)}$$

(However,  $\theta$  is an image pck-up field angle (half size))

Moreover, the one-way mirror coat is given to the 2nd page which faces across the vertex of cross-section 2 equilateral triangle of the above-mentioned prism. Moreover, the field which one is constituted by the above-mentioned housing and consists of two sides which face across the vertex of two equilateral triangles of this prism is made for the above-mentioned prism to function as the above-mentioned entrance window, respectively. Moreover, the above-mentioned prism is formed in the arris part which a chamfer constitutes from a vertex of two equilateral triangles, and the shading member is prepared in this chamfer. Moreover, the above-mentioned optical element consists of an image formation lens which is arranged by the preceding paragraph of the above-mentioned image pck-up element, and carries out image formation of the extraneous light on the image pck-up side of this image pck-up element, and a one-way mirror of the couple which made the predetermined angle mutually in the preceding paragraph of this image formation lens, and was symmetrically arranged to the optical axis of this image formation lens.

[0012] Housing with which the entrance window which the circumference check-by-looking equipment for vehicles concerning this invention is attached in the front part of vehicles, and takes in an extraneous light on both sides of right and left of the travelling direction of these vehicles, respectively was prepared, While reflecting once the extraneous light which carries out incidence of the image pck-up side from the image pck-up element arranged so that it might face at the front side of these vehicles, and a left-hand side entrance window in this housing and carrying out image formation of the handstand mirror image by this extraneous light to the field on the left-hand side of the image pck-up side of this image pck-up element The optical element which reflects once the extraneous light which carries out incidence from a right-hand side entrance window, and carries out image formation of the handstand mirror image by this extraneous light to the field on the right-hand side of the image pck-up side of this image pck-up element, It has a signal transformation means to carry out right-and-left reversal of the picture signal of the handstand mirror image by which image formation was carried out to this image pck-up side, and to change into the picture signal of a handstand normal image, and a display means to input the picture signal of the handstand normal image from this signal transformation means, and to display an erect normal image.

[0013] Moreover, the above-mentioned optical element consists of an image formation lens which is arranged by the preceding paragraph of the above-mentioned image pck-up element, and carries out

image formation of the extraneous light on the image pck-up side of this image pck-up element, and prism which the cross-section configuration was fabricated by the prism object of two equilateral triangles, and two bisectrices of the vertical angle of these two equilateral triangles were made in agreement with the optical axis of this image formation lens, and was arranged by the preceding paragraph of this image formation lens. Moreover, the field where the above-mentioned prism consists of bases of cross-section 2 equilateral triangle is formed in the lens side. Moreover, as for the above-mentioned prism, the vertical angle of cross-section 2 equilateral triangle is constituted by 60 degrees. Moreover, the above-mentioned prism has the refractive index  $N$  specified by the lower formula (3).  

$$60 \text{ degree} - \sin^{-1} \{ \sin(\theta/N) \} \geq \sin^{-1} (1/N) \text{ Formula (3)}$$

(However,  $\theta$  is an image pck-up field angle (half size))

Moreover, the one-way mirror coat is given to the 2nd page which faces across the vertex of cross-section 2 equilateral triangle of the following prism. Moreover, the field which one is constituted by the above-mentioned housing and consists of two sides which face across the vertex of two equilateral triangles of this prism is made for the above-mentioned prism to function as the above-mentioned entrance window, respectively. Moreover, the above-mentioned prism is formed in the arris part which a chamfer constitutes from a vertex of two equilateral triangles, and the shading member is prepared in this chamfer. Moreover, the above-mentioned optical element consists of an image formation lens which is arranged by the preceding paragraph of the above-mentioned image pck-up element, and carries out image formation of the extraneous light on the image pck-up side of this image pck-up element, and a one-way mirror of the couple which made the predetermined angle mutually in the preceding paragraph of this image formation lens, and was symmetrically arranged to the optical axis of this image formation lens. Moreover, the above-mentioned image pck-up element carries out right-and-left reversal, and it is made to output the picture signal of the handstand mirror image by which image formation was carried out to an image pck-up side, and it has a function as a signal transformation means.

[0014]

[Embodiments of the Invention] Hereafter, the form of implementation of this invention is explained about drawing.

Gestalt 1. drawing 1 of operation is the cross section showing the camera concerning the gestalt 1 of implementation of this invention, gives the same sign to the same as that of the conventional camera shown in drawing 13 and drawing 15 in drawing, or a considerable portion, and omits the explanation. With the gestalt 1 of this operation, the prism 1 by which the cross-section configuration was fabricated by the prism object of two equilateral triangles is arranged by the preceding paragraph of the image formation lens 3. And the optical axis of the image formation lens 3 and the arris part (intersection of Fields 2a and 2b) which two bisectrices of the vertical angle of the cross-section 2 equilateral triangle constitute from a vertex of two equilateral triangles in accordance with the optical axis of the image formation lens 3 cross at right angles in the vertical direction, and prism 1 is arranged so that the optical axis of the image formation lens 3 and the field (field 2c) constituted from a base of cross-section 2 equilateral triangle may cross at right angles. Here, the optical element consists of prism 1 and an image formation lens 3. And the mirror image CCD is used as an image pck-up element 13. That is, this mirror image CCD functions also as a signal transformation means to carry out right-and-left reversal and to output the picture signal which received light.

[0015] Thus, operation of the constituted camera 100 is explained. Through entrance window 4a, incidence of the extraneous light 5a from the right (it sets to drawing 1 and is the right) is carried out into the tank 4 as housing, and it results in prism 1. And extraneous light 5a penetrates field 2a, incidence of it is carried out into prism 1, and internal reflection is carried out in field 2b, it penetrates field 2c, and comes out of prism 1. Incidence of the extraneous light 5a which came out of prism 1 is carried out to the image formation lens 3, and it connects a handstand mirror image to the right half of the image pck-up side of the image pck-up element 13. On the other hand, through entrance window 4b, incidence of the extraneous light 5b from the left (it sets to drawing 1 and is the left) is carried out into a tank 4, and it results in prism 1. And extraneous light 5a penetrates field 2b, incidence of it is carried out into prism 1, and internal reflection is carried out in field 2a, it penetrates field 2c, and comes out of

prism 1. Incidence of the extraneous light 5b which came out of prism 1 is carried out to the image formation lens 3, and it connects a handstand mirror image to the left half of the image pck-up side of the image pck-up element 13.

[0016] When applying this camera 100 to the peripheral-vision private seal equipment for vehicles, the optical axis of the image formation lens 3 becomes level, and this camera 100 is attached in the anterior part bumper of vehicles so that the arris part which is an intersection of the fields 2a and 2b of prism 1 may turn to the front. And a camera 100 and a monitor TV are connected so that the output of the image pck-up element 13 may be inputted into the monitor TV as a display means. And in the right half of the image pck-up side of the image pck-up element 13, image formation of the handstand mirror image by extraneous light 5a which carried out incidence from the right of vehicles is carried out, and image formation of the handstand mirror image by extraneous light 5b which carried out incidence from the left of vehicles is carried out to the left half of the image pck-up side of the image pck-up element 13 in it. The picture signal of the handstand mirror image which received light with this image pck-up element 13 carries out right-and-left reversal, is changed into the picture signal of a handstand normal image, and is outputted from the image pck-up element 13, and it is displayed on a monitor TV that it becomes top-and-bottom reverse. Then, as shown in drawing 2, the erect normal image according [ the erect normal image by extraneous light 5a from the right ] to extraneous light 5b from the left is displayed on right screen 8a of a monitor TV 8 by left screen 8b, respectively. And an operator can check now the situation of a dead angle on either side from the screen of a monitor TV 8.

[0017] Thus, according to the gestalt 1 of this operation, the prism 1 fabricated by the prism object of cross-section 2 equilateral triangle is arranged in the preceding paragraph of the image formation lens 3. Since it is made to make the field by the side of field 2b of the image pck-up element 13 carry out image formation of the handstand mirror image by extraneous light 5b which the field by the side of field 2a of the image pck-up element 13 is made to carry out image formation of the handstand mirror image by extraneous light 5a which carries out incidence from field 2a, and carries out incidence from field 2b. Reflection of an extraneous light becomes only 1 time, simplification of composition is attained, and a small and cheap camera is obtained. Moreover, by carrying this camera 100 in vehicles, the erect normal image by the extraneous light from the right is displayed on the right screen of a monitor TV 8, the normal image by the extraneous light from the left is displayed on a left screen, and the peripheral-vision private seal equipment for vehicles of a legible picture is got by the operator whose direction of a screen display of a monitor TV 8 corresponded with the direction of incidence.

[0018] Although prism 1 shall be used with the form 1 of the form 2. above-mentioned implementation of operation as an optical element which reflects extraneous lights 5a and 5b once, respectively, and is led to the image formation lens 3, as shown in drawing 3, the one-way mirrors 12a and 12b of two sheets shall be used with the form 2 of this operation. In the preceding paragraph of the image formation lens 3, these one-way mirrors 12a and 12b make each nose of cam in agreement, detach between the back end, and are arranged in the bilateral symmetry to the optical axis of the image formation lens 3.

[0019] Thus, through entrance window 4a, in a tank 4, incidence of the extraneous light 5a from the right (it sets to drawing 3 and is the right) is carried out, and it results with the constituted camera 101 at one-way mirror 12a. And one-way mirror 12a is penetrated, it is reflected in one-way mirror 12b, and incidence of the extraneous light 5a is carried out to the image formation lens 3, and it connects a handstand mirror image to the right half of the image pck-up side of the image pck-up element 13. On the other hand, through entrance window 4b, in a tank 4, incidence of the extraneous light 5b from the left (it sets to drawing 3 and is the left) is carried out, and it results at one-way mirror 12b. And one-way mirror 12b is penetrated, it is reflected in one-way mirror 12a, and incidence of the extraneous light 5b is carried out to the image formation lens 3, and it connects a handstand mirror image to the left half of the image pck-up side of the image pck-up element 13.

[0020] Therefore, also in the camera 101 by the form 2 of this operation, the same effect as the form 1 of the above-mentioned implementation is acquired. Moreover, also in the circumference check-by-looking equipment for vehicles which applied this camera 101, the same effect as the form 1 of the above-mentioned implementation is acquired.

[0021] form 3. of operation -- the one-way mirror coat shall be given to the fields 2a and 2b of prism 1 with the form 3 of this operation In addition, other composition is constituted like the form 1 of the above-mentioned implementation.

[0022] According to the form 3 of this operation, since the one-way mirror coat is given to Fields 2a and 2b, the predetermined reflection factor in Fields 2a and 2b can be obtained irrespective of the refractive index of the \*\* material of prism 1. Then, as \*\* material of prism 1, although a refractive index is low, it is cheap, and optical materials, such as PMMA excellent in the moldability, can be used, and low-cost-ization can be attained. Moreover, even if it applies the camera by the form 3 of this operation to the circumference check-by-looking equipment for vehicles, the same effect as the form 1 of the above-mentioned implementation is acquired.

[0023] form 4. of operation -- with the form 4 of this operation, prism 1A fabricated by the prism object of the cross-section equilateral triangle whose angle which Fields 2a, 2b, and 2c make is 60 degrees shall be used In addition, other composition is constituted like the form 1 of the above-mentioned implementation.

[0024] Generally, when prism is arranged in the preceding paragraph of the image formation lens 3, color bleeding will occur in the picture acquired by originating in distribution of light. However, according to the form 4 of this operation, since prism 1 is fabricated by the prism object of a cross-section equilateral triangle, prism 1A will become equivalent to an optical-character ability Kamitaira line plate, and color bleeding does not occur, but a high-definition image can be obtained. Moreover, if the camera by the form 4 of this operation is applied to the circumference check-by-looking equipment for vehicles, since a high-definition monitor TV picture will be acquired, it becomes easier for an operator to recognize the situation of a dead angle.

[0025] Below, why prism 1A will become equivalent to an optical-character ability Kamitaira line plate is explained based on drawing 4 . In drawing 4 , a symmetrical beam of light is made into an extraneous light five a1 to field 2b of extraneous light 5a, and a symmetrical field is made into a field two a1 to field 2b of field 2a. Even if it transposes extraneous light 5a reflected by field 2b to the extraneous light five a1 which penetrates field 2b at this time, the optical-character ability top is equivalent. And a field two a1 and field 2c will penetrate the parallel plate to which a bird clapper to the extraneous light five a1 becomes parallel from two fields two a1 and 2c. That is, extraneous light 5a becomes equivalent on two fields two a1, and penetrating the parallel plate which consists of 2c and optical-character ability.

[0026] form 5. of operation -- with the form 5 of this operation, as shown in drawing 5 , prism 1B fabricated by the prism object of the cross-section sector which the angle which Fields 2a and 2b make is 60 degrees, and makes Field c the spherical surface which is a lens side shall be used In addition, other composition is constituted like the form 1 of the above-mentioned implementation. Prism 1B by the form 5 of this operation is considered to be the synthetic body of prism 1a fabricated by the prism object of a cross-section equilateral triangle, and prism 1b by which the inside by the side of prism 1a is a flat surface, and external surface was fabricated by the spherical surface as shown in drawing 6 . Then, according to the camera 102 of the form 5 of this operation, like the form 4 of the above-mentioned implementation, generating of color bleeding can be prevented and a high-definition image is obtained by prism 1a. Furthermore, since prism 1b has a lens function, the image formation lens 3 can be simplified or omitted. Moreover, even if it applies the camera by the form 5 of this operation to the circumference check-by-looking equipment for vehicles, the same effect as the form 1 of the above-mentioned implementation is acquired.

[0027] gestalt 6. of operation -- the gestalt 6 of this operation specifies the refractive index of the \*\* material of prism 1A fabricated by the prism object of the cross-section equilateral triangle in the gestalt 4 of the above-mentioned implementation That is, after extraneous light 5b from the left penetrates field 2b of prism 1A after extraneous light 5a from the right penetrates field 2a of prism 1A so that the incident angle to field 2b may turn into more than a critical angle and, the refractive index of \*\* material is prescribed that the incident angle to field 2a turns into more than a critical angle. According to the gestalt 6 of this operation, since total reflection of the extraneous lights 5a and 5b is carried out in respect of 2b and 2a, respectively, incidence can be carried out to the image formation lens 3, without

losing the quantity of light of extraneous lights 5a and 5b, and a high-definition image is obtained. Moreover, if the camera by the gestalt 6 of this operation is applied to the peripheral-vision private seal equipment for vehicles, since a high-definition monitor TV picture will be acquired, it becomes easier for an operator to recognize the situation of a dead angle.

[0028] Here, the refractive index  $N$  of the \*\* material from which the incident angle to field 2a turns into more than a critical angle is explained based on drawing 7. The refraction in field 2c of prism 1A is expressed by the formula (1) by the theorem of Snell (Snell). It is an incident angle [ as opposed to / this time / as opposed to / the field angle (half size) of the image formation lens 3 / in theta ] field 2c in theta 1 /. Then, the incident angle to field 2b of prism 1 is set to 60 degree-theta1, and the conditions which carry out total reflection by field 2b are expressed with a formula (2). Therefore, a formula (3) is obtained from a formula (1) and a formula (2). Then, what is necessary is just to produce prism 1A using the \*\* material of a refractive index which satisfies a formula (3).

$N \cdot \sin \theta_1 = \sin \theta_2$  (1)

$60 \text{ degree} - \theta_1 \geq \sin^{-1} (1/N)$  (2)

$60 \text{ degree} - \sin^{-1} (\sin \theta_2 / N) \geq \sin^{-1} (1/N)$  (3)

However, theta : Field angle of an image formation lens (half size)

$N$  : -- refractive-index theta1: of the \*\* material of prism -- the incident angle to field 2c of prism -- here, the refractive index  $N$  of 30 degrees, then prism 1A should just be 1.52753 or more about the field angle theta of the image formation lens 3 as an example

[0029] In addition, with the gestalt 6 of the above-mentioned implementation, although prism 1A in the gestalt 4 of the above-mentioned implementation is explained, when the image pick-up field angle which compounded prism 1b which is the lens component of prism 1B [ in / the gestalt 5 of the above-mentioned implementation / for theta (field angle of an image formation lens) in an above-mentioned formula (3) ], and the image formation lens 3 is considered, it turns out that it is applicable also to the gestalt 5 of the above-mentioned implementation.

[0030] gestalt 7. of operation -- as shown in drawing 8, prism 1 shall consist of gestalten 7 of this operation in a tank 4 and one In addition, other composition is constituted like the gestalt 1 of the above-mentioned implementation.

[0031] Thus, since prism 1 is constituted by a tank 4 and one, as for the constituted camera 103, the miniaturization of equipment is attained. Moreover, if the camera 103 by the gestalt 7 of this operation is applied to the peripheral-vision private seal equipment for vehicles, capacity of a tank 4 can be made small and the miniaturization of the part equipment can be attained.

[0032] In addition, although prism 1 shall be constituted from a gestalt 7 of the above-mentioned implementation in a tank 4 and one in the gestalt 1 of operation, you may apply to the gestalt of other operations.

[0033] gestalt 8. of operation -- with the gestalt 8 of this operation, as shown in drawing 9, a boundary line 19 is displayed on the boundary of right picture 8a of a picture and left picture 8b which are displayed on a monitor TV 8 In addition, the camera carried in vehicles shall use either of the cameras in the gestalt of each above-mentioned implementation. And the signal of a line is added and it is made to output on a video signal on a camera circuit as a means to display a boundary line 19, with the gestalt 8 of this operation. Therefore, the peripheral-vision private seal equipment for vehicles with which a legible picture is acquired by the operator is obtained.

[0034] In addition, although the signal of a line is added and it is made to output on a video signal on a camera circuit as a means to display a boundary line 19, with the gestalt 8 of the above-mentioned implementation, the signal of a line may be added on the circuit of a monitor TV 8, and a line may be drawn on the screen of a monitor TV 8.

[0035] With the gestalt 9 of this operation, although the signal of a line is added and it is made to output on a video signal on a camera circuit as a means to display a boundary line 19, with the gestalt 8 of the gestalt 9. above-mentioned implementation of operation, as shown in drawing 10, the arris part of prism 1A should be beveled and Japanese ink 15 shall be applied to the chamfer 14 as a shading member.

Since image formation of the image of a chamfer 14 is carried out on the image pick-up element 13 with



the handstand mirror image by the extraneous lights 5a and 5b from a longitudinal direction, a boundary line 19 is expressed on the boundary of right picture 8a of a monitor TV 8, and left picture 8b as the gestalt 9 of this operation. Therefore, also in the camera by the gestalt 9 of this operation, the same effect as the gestalt 8 of the above-mentioned implementation is acquired. Moreover, if the camera by the gestalt 9 of this operation is applied to the peripheral-vision private seal equipment for vehicles, a boundary line 19 will be displayed between the pictures of the right and left displayed on a monitor TV screen, and it will become easy for an operator to recognize the situation of a dead angle by \*\*.

[0036] In addition, with the gestalt of each above-mentioned implementation, right-and-left reversal of the picture signal of the mirror image by which image formation was carried out on the image pck-up side of the image pck-up element 13 shall be carried out using a mirror image CCD as an image pck-up element 13, and it shall change and output to the picture signal of a normal image. However, the data-processing circuit which carries out the right-and-left reversal process of the mirror image monitor TV which right and left of a picture reverse, or the picture signal that what is necessary is just what carries out right-and-left reversal not only of the mirror image CCD but the picture signal as a neologism conversion means to carry out right-and-left reversal of the picture signal of a mirror image, and to change into the picture signal of a normal image can be used. Furthermore, an operator makes it reflect in a mirror and may be made to observe the screen of the usual monitor TV.

[0037] Moreover, the gestalt of each above-mentioned implementation explains as what carries out image formation of the handstand mirror image by the extraneous lights 5a and 5b which carry out incidence to a tank 4 from a longitudinal direction to the right and left on the image pck-up side of the image pck-up element 13 simultaneously. However, the extraneous light for carrying out image formation of the camera of this application on the image pck-up side of the image pck-up element 13 is not limited to the light which carries out incidence to a tank 4 from a longitudinal direction, and can carry out image formation of the handstand mirror image by the extraneous light which carries out incidence from the 2-way which faces on both sides of a tank 4 simultaneously on the image pck-up element 13 by one reflection by changing the posture of a camera.

[0038]

[Effect of the Invention] Since this invention is constituted as mentioned above, it does so an effect which is indicated below.

[0039] Housing with which the entrance window which takes in an extraneous light, respectively was prepared in both sides according to this invention, While reflecting once the extraneous light which carries out incidence from the image pck-up element arranged in this housing, and the entrance window of an unilateral and carrying out image formation of the handstand mirror image by this extraneous light to the field by the side of the entrance window of this unilateral of the image pck-up side of this image pck-up element Since the extraneous light which carries out incidence from the entrance window of the side else was reflected once and the field by the side of the entrance window of the side other than [ this ] the image pck-up side of this image pck-up element is equipped with the optical element which carries out image formation of the handstand mirror image by this extraneous light, reflection of an extraneous light becomes only 1 time, simplification of composition is attained, and a small and cheap camera is obtained.

[0040] Moreover, the image formation lens which the above-mentioned optical element is arranged by the preceding paragraph of the above-mentioned image pck-up element, and carries out image formation of the extraneous light on the image pck-up side of this image pck-up element, Since it consists of prism with which the cross-section configuration was fabricated by the prism object of two equilateral triangles, made two bisectrices of the vertical angle of these two equilateral triangles in agreement with the optical axis of this image formation lens, and was arranged by the preceding paragraph of this image formation lens, simplification of the composition of an optical element is attained. Moreover, since the field where the above-mentioned prism consists of bases of cross-section 2 equilateral triangle is formed in the lens side, simplification of an image formation lens is attained. Moreover, since the vertical angle of cross-section 2 equilateral triangle is constituted by 60 degrees, generating of color bleeding is suppressed and, as for the above-mentioned prism, a high-definition picture is acquired. Moreover, since

the above-mentioned prism has the refractive index  $N$  specified by the lower formula (3), there is no loss of the quantity of light of an extraneous light, and a high-definition picture is acquired.

$60 \text{ degree} \cdot \sin^{-1} \{ \sin(\theta/N) \} \geq \sin^{-1} (1/N)$  Formula (3)

(However,  $\theta$  is an image pick-up field angle (half size))

Moreover, since the one-way mirror coat is given to the 2nd page which faces across the vertex of cross-section 2 equilateral triangle of the above-mentioned prism, \*\* material with a low refractive index can be used for the material of prism, and the part low-cost-ization is attained. Moreover, since the field which one is constituted by the above-mentioned housing and consists of two sides which face across the vertex of two equilateral triangles of this prism was made for the above-mentioned prism to function as the above-mentioned entrance window, respectively, the miniaturization of equipment is attained. Moreover, the boundary line between the pictures by which image formation is carried out to the image pick-up side of an image pick-up element is obtained, without carrying out special signal processing, since the above-mentioned prism is formed in the arris part which a chamfer constitutes from a vertex of two equilateral triangles and the shading member is prepared in this chamfer. Moreover, since the above-mentioned optical element consists of an image formation lens which is arranged by the preceding paragraph of the above-mentioned image pick-up element, and carries out image formation of the extraneous light on the image pick-up side of this image pick-up element, and a one-way mirror of the couple which made the predetermined angle mutually in the preceding paragraph of this image formation lens, and was symmetrically arranged to the optical axis of this image formation lens, simplification of the composition of an optical element is attained and low-cost-ization is attained further.

[0041] Housing with which the entrance window which according to this invention is attached in the anterior part of vehicles and takes in an extraneous light on both sides of right and left of the travelling direction of these vehicles, respectively was prepared, While reflecting once the extraneous light which carries out incidence of the image pick-up side from the image pick-up element arranged so that it might face at the front side of these vehicles, and a left-hand side entrance window in this housing and carrying out image formation of the handstand mirror image by this extraneous light to the field on the left-hand side of the image pick-up side of this image pick-up element The optical element which reflects once the extraneous light which carries out incidence from a right-hand side entrance window, and carries out image formation of the handstand mirror image by this extraneous light to the field on the right-hand side of the image pick-up side of this image pick-up element, Since it has a signal transformation means to carry out right-and-left reversal of the picture signal of the handstand mirror image by which image formation was carried out to this image pick-up side, and to change into the picture signal of a handstand normal image, and a display means to input the picture signal of the handstand normal image from this signal transformation means, and to display an erect normal image The erect normal image by the extraneous light from the right is displayed on the right screen of a display means, and the erect normal image by the extraneous light from the left is displayed on a left screen. The peripheral-vision private seal equipment for vehicles of the screen where the direction of a screen display is legible to the operator who was in agreement with the direction of incidence of an extraneous light is obtained.

[0042] Moreover, the image formation lens which the above-mentioned optical element is arranged by the preceding paragraph of the above-mentioned image pick-up element, and carries out image formation of the extraneous light on the image pick-up side of this image pick-up element, Since it consists of prism with which the cross-section configuration was fabricated by the prism object of two equilateral triangles, made two bisectrices of the vertical angle of these two equilateral triangles in agreement with the optical axis of this image formation lens, and was arranged by the preceding paragraph of this image formation lens, simplification of the composition of an optical element is attained. Moreover, since the field which consists of bases of cross-section 2 equilateral triangle is formed in the lens side, simplification or simplification of an image formation lens is attained, and the part miniaturization of the above-mentioned prism is attained. Moreover, the high-definition image display which generating of color bleeding is suppressed and is easy to recognize the above-mentioned prism to an operator since the vertical angle of cross-section 2 equilateral triangle is constituted by 60 degrees is obtained. Moreover,

the high-definition image display which loss of the quantity of light of an extraneous light is lost, and is easy to recognize to an operator since the above-mentioned prism has the refractive index  $N$  specified by the lower formula (3) is obtained.

60 degree- $\sin^{-1} \{ \sin(\theta/N) \} \geq \sin^{-1} (1/N)$  Formula (3)

(However,  $\theta$  is an image pick-up field angle (half size))

Moreover, since the one-way mirror coat is given to the 2nd page which faces across the vertex of cross-section 2 equilateral triangle of the following prism, \*\* material with a low refractive index can be used for the material of prism, and the part low-cost-ization is attained. Moreover, since the field which one is constituted by the above-mentioned housing and consists of two sides which face across the vertex of two equilateral triangles of this prism was made for the above-mentioned prism to function as the above-mentioned entrance window, respectively, the miniaturization of equipment is attained. Moreover, since the above-mentioned prism is formed in the arris part which a chamfer constitutes from a vertex of two equilateral triangles and the shading member is prepared in this chamfer, the boundary line between the pictures by which image formation is carried out is displayed on the image pick-up side of an image pick-up element, without performing special signal processing, and legible image display is got by the operator. Moreover, since the above-mentioned optical element consists of an image formation lens which is arranged by the preceding paragraph of the above-mentioned image pick-up element, and carries out image formation of the extraneous light on the image pick-up side of this image pick-up element, and a one-way mirror of the couple which made the predetermined angle mutually in the preceding paragraph of this image formation lens, and was symmetrically arranged to the optical axis of this image formation lens, simplification of the composition of an optical element is attained. Moreover, since the above-mentioned image pick-up element carries out right-and-left reversal, it is made to output the picture signal of the handstand mirror image by which image formation was carried out to an image pick-up side and it has a function as a signal transformation means, it is not necessary to establish a special signal transformation means, and a miniaturization and low-cost-izing of equipment are attained.

---

[Translation done.]

(19) 日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開平10-229512

(43) 公開日 平成10年(1998) 8月25日

(51) Int.Cl.<sup>8</sup>

識別記号

F I

H 0 4 N 5/225

H 0 4 N 5/225

C

B 6 0 R 1/00

B 6 0 R 1/00

A

審査請求 未請求 請求項の数19 O L (全 12 頁)

(21) 出願番号

特願平9-30264

(22) 出願日

平成 9 年(1997) 2月14日

(71) 出願人 000006013

三菱電機株式会社

東京都千代田区丸の内二丁目2番3号

(72) 発明者 阪田 一樹

東京都千代田区丸の内二丁目2番3号 三

菱電機株式会社内

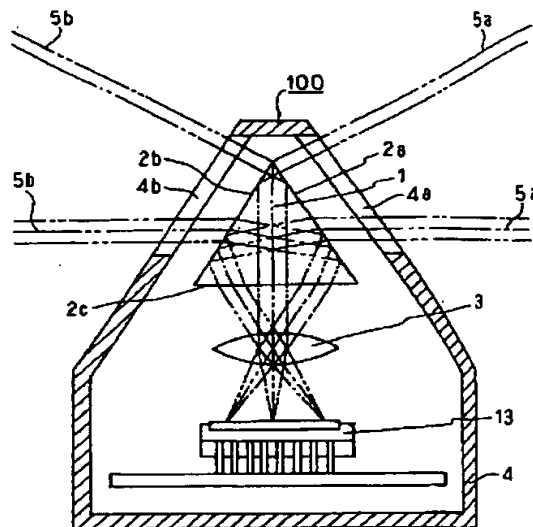
(74) 代理人 弁理士 曾我 道照 (外 6 名)

(54) 【発明の名称】 カメラおよびそれを用いた車両用周辺視認装置

(57) 【要約】

【課題】 この発明は、運転者に見やすい車両用周辺視認装置に適用できる小型で安価なカメラを得ることを目的とする。

【解決手段】 プリズム1が結像レンズ3の前段に配設されている。入射窓4aから入射する外部光5aはプリズム1の面2bで反射され、結像レンズ3に導かれる。そして、結像レンズ3に導かれた外部光5aは撮像素子13の撮像面の入射窓4a側の領域に倒立鏡像として結像される。一方、入射窓4bから入射する外部光5bはプリズム1の面2aで反射され、結像レンズ3に導かれる。そして、結像レンズ3に導かれた外部光5bは撮像素子13の撮像面の入射窓4b側の領域に倒立鏡像として結像される。



- 1: プリズム (光学素子)
- 3: 結像レンズ (光学素子)
- 4: 外箱 (ハウジング)
- 4a, 4b: 入射窓
- 5a, 5b: 外部光
- 13: 撮像素子
- 100: カメラ

## 【特許請求の範囲】

【請求項1】 両側にそれぞれ外部光を取り入れる入射窓が設けられたハウジングと、このハウジング内に配設された撮像素子と、一側の入射窓から入射する外部光を1回反射して、前記撮像素子の撮像面の該一側の入射窓側の領域に該外部光による倒立鏡像を結像するとともに、他側の入射窓から入射する外部光を1回反射して、前記撮像素子の撮像面の該他側の入射窓側の領域に該外部光による倒立鏡像を結像する光学素子とを備えたことを特徴とするカメラ。

【請求項2】 上記光学素子は、上記撮像素子の前段に配設されて外部光を該撮像素子の撮像面上に結像する結像レンズと、断面形状が2等辺三角形の角柱体に成形さ\*

$$60^\circ - \sin^{-1} \{ \sin(\theta/N) \} \geq \sin^{-1}(1/N) \quad \text{式(3)}$$

(但し、 $\theta$ は撮像画角(半角)である)

【請求項6】 上記プリズムの断面2等辺三角形の頂点を挟む2面にハーフミラーコートが施されていることを特徴とする請求項2乃至4のいずれかに記載のカメラ。

【請求項7】 上記プリズムは、上記ハウジングに一体の構成され、該プリズムの2等辺三角形の頂点を挟む2辺で構成される面をそれぞれ上記入射窓として機能するようにしたことを特徴とする請求項2乃至6のいずれかに記載のカメラ。

【請求項8】 上記プリズムは、面取り部が2等辺三角形の頂点で構成する稜部に形成され、遮光部材が該面取り部に設けられていることを特徴とする請求項2乃至7のいずれかに記載のカメラ。

【請求項9】 上記光学素子は、上記撮像素子の前段に配設されて外部光を該撮像素子の撮像面上に結像する結像レンズと、前記結像レンズの前段に、互いに所定の角度をなして該結像レンズの光軸に対して対称に配設された一対のハーフミラーとから構成されていることを特徴とする請求項1記載のカメラ。

【請求項10】 車両の前部に取り付けられ、該車両の進行方向の左右の両側にそれぞれ外部光を取り入れる入射窓が設けられたハウジングと、このハウジング内に撮像面を前記車両の前方側に面するように配設された撮像素子と、左側の入射窓から入射する外部光を1回反射して、前記撮像素子の撮像面の左側の領域に該外部光によ\*

$$60^\circ - \sin^{-1} \{ \sin(\theta/N) \} \geq \sin^{-1}(1/N) \quad \text{式(3)}$$

(但し、 $\theta$ は撮像画角(半角)である)

【請求項15】 上記プリズムの断面2等辺三角形の頂点を挟む2面にハーフミラーコートが施されていることを特徴とする請求項11乃至13のいずれかに記載の車両用周辺視認装置。

【請求項16】 上記プリズムは、上記ハウジングに一体の構成され、該プリズムの2等辺三角形の頂点を挟む2辺で構成される面をそれぞれ上記入射窓として機能するようにしたことを特徴とする請求項11乃至15のいずれかに記載の車両用周辺視認装置。

\*れ、該2等辺三角形の頂角の2等分線を前記結像レンズの光軸に一致させて、該結像レンズの前段に配設されたプリズムとから構成されていることを特徴とする請求項1記載のカメラ。

【請求項3】 上記プリズムは、断面2等辺三角形の底辺で構成される面がレンズ面に形成されていることを特徴とする請求項2記載のカメラ。

【請求項4】 上記プリズムは、断面2等辺三角形の頂角が60度に構成されていることを特徴とする請求項2または3記載のカメラ。

【請求項5】 上記プリズムは、下式(3)で規定される屈折率Nを有することを特徴とする請求項2乃至4のいずれかに記載のカメラ。

$$60^\circ - \sin^{-1} \{ \sin(\theta/N) \} \geq \sin^{-1}(1/N) \quad \text{式(3)}$$

※る倒立鏡像を結像するとともに、右側の入射窓から入射する外部光を1回反射して、前記撮像素子の撮像面の右側の領域に該外部光による倒立鏡像を結像する光学素子と、前記撮像面に結像された倒立鏡像の画像信号を左右反転して倒立正像の画像信号に変換する信号変換手段と、前記信号変換手段からの倒立正像の画像信号を入力して正立正像を表示する表示手段とを備えたことを特徴とする車両用周辺視認装置。

【請求項11】 上記光学素子は、上記撮像素子の前段に配設されて外部光を該撮像素子の撮像面上に結像する結像レンズと、断面形状が2等辺三角形の角柱体に成形され、該2等辺三角形の頂角の2等分線を前記結像レンズの光軸に一致させて、該結像レンズの前段に配設されたプリズムとから構成されていることを特徴とする請求項10記載の車両用周辺視認装置。

【請求項12】 上記プリズムは、断面2等辺三角形の底辺で構成される面がレンズ面に形成されていることを特徴とする請求項11記載の車両用周辺視認装置。

【請求項13】 上記プリズムは、断面2等辺三角形の頂角が60度に構成されていることを特徴とする請求項11または12記載の車両用周辺視認装置。

【請求項14】 上記プリズムは、下式(3)で規定される屈折率Nを有することを特徴とする請求項11乃至13のいずれかに記載の車両用周辺視認装置。

$$60^\circ - \sin^{-1} \{ \sin(\theta/N) \} \geq \sin^{-1}(1/N) \quad \text{式(3)}$$

【請求項17】 上記プリズムは、面取り部が2等辺三角形の頂点で構成する稜部に形成され、遮光部材が該面取り部に設けられていることを特徴とする請求項11乃至16のいずれかに記載の車両用周辺視認装置。

【請求項18】 上記光学素子は、上記撮像素子の前段に配設されて外部光を該撮像素子の撮像面上に結像する結像レンズと、前記結像レンズの前段に、互いに所定の角度をなして該結像レンズの光軸に対して対称に配設された一対のハーフミラーとから構成されていることを特徴とする請求項10記載の車両用周辺視認装置。

【請求項19】 上記撮像素子は、撮像面に結像された倒立鏡像の画像信号を左右反転して出力するようにし、信号変換手段としての機能を有することを特徴とする請求項10乃至18のいずれかに記載の車両用周辺視認装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】この発明は、複数方向を同時に撮像できるカメラおよびそれを用いた車両用周辺視認装置に関するものである。

【0002】

【従来の技術】図11は従来の車両用周辺視認装置を搭載した車両の動作を示す説明する図である。一般に、車両15が交差点に入ろうとするとき、運転者には、図11に斜線で示される領域が死角17になってしまう。そして、運転者には、この左右の死角17に存在する他の車両16を視認することができない。そこで、運転者に死角17の状況を視認させるために、車両の前部カバーにカメラ18が取り付けられ、該カメラ18により左右の死角17を同時に撮影して、図12に示されるような死角17の画像をモニタテレビ8の画面に表示させる車両用周辺視認装置が実用化されている。

【0003】つぎに、従来のカメラの一例を図13に基づいて説明する。ハウジングとしての外箱4は、左右に入射窓4a、4bが設けられ、左右の外部光が入射できるようになっている。そして、結像レンズ3が外箱4内に取り付けられ、CCDで構成された撮像素子13が結像レンズ3の焦点位置に配設されている。また、一對の第1のミラー10a、10bが結像レンズ3の左右に配設されている。さらに、一對の第2のミラー11a、11bが一對の第1のミラー10a、10bに相対して配設されている。

【0004】このように構成されたカメラ18Aでは、右方向（図13において上方向）からの外部光5aは入射窓4aを通過して外箱4内に入射し、まず第1のミラー10aで反射され、次いで第2のミラー11aで反射される。この第2のミラー11aで反射された外部光5aは結像レンズ3に導かれ、撮像素子13の撮像面の左半分に倒立正像を結ぶ。一方、左方向（図13において下方向）からの外部光5bは入射窓4bを通過して外箱4内に入射し、まず第1のミラー10bで反射され、次いで第2のミラー11bで反射される。この第2のミラー11bで反射された外部光5bは結像レンズ3に導かれ、撮像素子13の撮像面の右半分に倒立正像を結ぶ。そこで、このカメラ18Aを車両用周辺視認装置に適用した場合、撮像素子13で受光した倒立正像の画像信号が、天地逆となるようにモニタテレビの画面に表示される。そこで、図12に示されるように、モニタテレビ8の右画面8aには、右方向からの外部光5aによる正像が、左画面8bには左方向からの外部光5bによる正像がそ

れぞれ表示される。そして、運転者がモニタテレビの画面から左右の死角の状況を確認できるようになっている。

【0005】このカメラ18Aでは、外部光5a（5b）を第1および第2のミラー10a、11a（10b、11b）で2回反射させることにより、即ち第1のミラー10a（10b）で鏡像となった画像を第2のミラー11a（11b）により正像にしている。ここで、第2のミラー11a（11b）を用いず、第1のミラー10a（10b）のみを用いた場合、撮像素子13で受光した画像は倒立鏡像となる。この場合、撮像素子13として受光信号を左右反転して出力する鏡像CCDを用いることになる。そして、受光した倒立鏡像の画像信号は左右反転して倒立正像の画像信号として撮像素子13から出力され、天地逆となるようにモニタテレビに表示させる。そこで、図14に示されるように、モニタテレビ8の右画面8aには左方向からの外部光5bによる正像が、左画面8bには右方向からの外部光5aによる正像が表示されてしまう。その結果、モニタテレビの画面表示方向が入射方向と逆となり、運転者には見にくい画面となってしまふ。

【0006】ついで、従来のカメラの他の例を図15に基づいて説明する。このカメラ18Bは、反射ミラーに代えてプリズムを用い、撮像素子13として鏡像CCDを用いる点を除いて、上述のカメラ18Aと同様に構成されている。即ち、一對のプリズム6a、6bが結像レンズ3の前段に、結像レンズ3に中心軸を挟んで上下に並設されたものである。

【0007】このように構成されたカメラ18Bでは、右方向（図15において右方向）からの外部光5aは入射窓4aを通過して外箱4内に入射し、プリズム6aに入射し、反射面7aで反射されて結像レンズ3に導かれ、撮像素子13の撮像面の下半分に倒立鏡像を結ぶ。一方、左方向（図15において左方向）からの外部光5bは入射窓4bを通過して外箱4内に入射し、プリズム6bに入射し、反射面7bで反射されて結像レンズ3に導かれ、撮像素子13の撮像面の上半分に倒立鏡像を結ぶ。このカメラ18Bでは、反射が1回であるので、小型化が図れるものの、撮像素子13に結像される画像は鏡像となってしまふ。そこで、このカメラ18Bを車両用周辺視認装置に適用した場合、撮像素子13で受光した倒立鏡像の画像信号が、左右反転されて撮像素子13から出力され、天地逆となるようにモニタテレビの画面に表示される。そこで、図16に示されるように、モニタテレビ8の上画面9aには、右方向からの外部光5aによる正像が、下画面9bには左方向からの外部光5bによる正像がそれぞれ表示される。そして、運転者がモニタテレビの画面から左右の死角の状況を確認できるようになっている。

【0008】

【発明が解決しようとする課題】従来の反射ミラーを用いたカメラ18Aは以上のように、第1のミラーと第2のミラーとにより2回反射させているので、装置の寸法がおおきくなってしまいう課題があった。一方、2つのプリズムを用いたカメラ18Bは以上のように、モニタテレビの上画面9aが右方向からの外部光5aによる正像となり、下画面9bが左方向からの外部光5bによる正像となる。そこで、このカメラ18Bを車両用周辺視認装置に適用した場合、モニタテレビに表示される画面が運転者には見にくい画面となってしまうという課題があった。また、プリズムが複数個必要であり、低コスト化が図れないという課題もあった。

【0009】この発明は、上記のような課題を解決するためになされたもので、ひかりの反射を1回として、構成の簡素化を図り、小型で安価なカメラを得ることを目的とする。また、モニタテレビの右画面に右方向からの外部光による正像を、左画面に左方向からの外部光による正像を表示させて、運転者に見やすい画像が得られる車両用周辺視認装置を得ることを目的とする。

【0010】

$$60^\circ - \sin^{-1} \{ \sin(\theta/N) \} \geq \sin^{-1}(1/N) \quad \text{式(3)}$$

(但し、 $\theta$ は撮像画角(半角)である)

また、上記プリズムの断面2等辺三角形の頂点を挟む2面にハーフミラーコートが施されているものである。また、上記プリズムは、上記ハウジングに一体の構成され、該プリズムの2等辺三角形の頂点を挟む2辺で構成される面をそれぞれ上記入射窓として機能するようにしたものである。また、上記プリズムは、面取り部が2等辺三角形の頂点で構成する稜部に形成され、遮光部材が該面取り部に設けられているものである。また、上記光学素子は、上記撮像素子の前段に配設されて外部光を該撮像素子の撮像面上に結像する結像レンズと、該結像レンズの前段に、互いに所定の角度をなして該結像レンズの光軸に対して対称に配設された一対のハーフミラーとから構成されているものである。

【0012】この発明に係る車両用周辺視認装置は、車両の前部に取り付けられ、該車両の進行方向の左右の両側にそれぞれ外部光を取り入れる入射窓が設けられたハウジングと、このハウジング内に撮像面を該車両の前方側に面するように配設された撮像素子と、左側の入射窓から入射する外部光を1回反射して、該撮像素子の撮像※

$$60^\circ - \sin^{-1} \{ \sin(\theta/N) \} \geq \sin^{-1}(1/N) \quad \text{式(3)}$$

(但し、 $\theta$ は撮像画角(半角)である)

また、下記プリズムの断面2等辺三角形の頂点を挟む2面にハーフミラーコートが施されているものである。また、上記プリズムは、上記ハウジングに一体の構成され、該プリズムの2等辺三角形の頂点を挟む2辺で構成される面をそれぞれ上記入射窓として機能するようにしたものである。また、上記プリズムは、面取り部が2等辺三角形の頂点で構成する稜部に形成され、遮光部材が

\*【課題を解決するための手段】この発明に係るカメラは、両側にそれぞれ外部光を取り入れる入射窓が設けられたハウジングと、このハウジング内に配設された撮像素子と、一側の入射窓から入射する外部光を1回反射して、該撮像素子の撮像面の該一側の入射窓側の領域に該外部光による倒立鏡像を結像するとともに、他側の入射窓から入射する外部光を1回反射して、該撮像素子の撮像面の該他側の入射窓側の領域に該外部光による倒立鏡像を結像する光学素子とを備えたものである。

【0011】また、上記光学素子は、上記撮像素子の前段に配設されて外部光を該撮像素子の撮像面上に結像する結像レンズと、断面形状が2等辺三角形の角柱体に形成され、該2等辺三角形の頂角の2等分線を該結像レンズの光軸に一致させて、該結像レンズの前段に配設されたプリズムとから構成されているものである。また、上記プリズムは、断面2等辺三角形の底辺で構成される面がレンズ面に形成されているものである。また、上記プリズムは、断面2等辺三角形の頂角が60度に構成されているものである。また、上記プリズムは、下式(3)で規定される屈折率Nを有するものである。

\*20

※面の左側の領域に該外部光による倒立鏡像を結像するとともに、右側の入射窓から入射する外部光を1回反射して、該撮像素子の撮像面の右側の領域に該外部光による倒立鏡像を結像する光学素子と、該撮像面に結像された倒立鏡像の画像信号を左右反転して倒立正像の画像信号に変換する信号変換手段と、該信号変換手段からの倒立正像の画像信号を入力して正立正像を表示する表示手段とを備えたものである。

【0013】また、上記光学素子は、上記撮像素子の前段に配設されて外部光を該撮像素子の撮像面上に結像する結像レンズと、断面形状が2等辺三角形の角柱体に形成され、該2等辺三角形の頂角の2等分線を該結像レンズの光軸に一致させて、該結像レンズの前段に配設されたプリズムとから構成されているものである。また、上記プリズムは、断面2等辺三角形の底辺で構成される面がレンズ面に形成されているものである。また、上記プリズムは、断面2等辺三角形の頂角が60度に構成されているものである。また、上記プリズムは、下式(3)で規定される屈折率Nを有するものである。

該面取り部に設けられているものである。また、上記光学素子は、上記撮像素子の前段に配設されて外部光を該撮像素子の撮像面上に結像する結像レンズと、該結像レンズの前段に、互いに所定の角度をなして該結像レンズの光軸に対して対称に配設された一対のハーフミラーとから構成されているものである。また、上記撮像素子は、撮像面に結像された倒立鏡像の画像信号を左右反転して出力するようにし、信号変換手段としての機能を有

するものである。

#### 【0014】

【発明の実施の形態】以下、この発明の実施の形態を図について説明する。

実施の形態1. 図1はこの発明の実施の形態1に係るカメラを示す断面図であり、図において図13および図15に示した従来のカメラと同一または相当部分には同一符号を付し、その説明を省略する。この実施の形態1では、断面形状が2等辺三角形の角柱体に成形されたプリズム1が結像レンズ3の前段に配設されている。そして、プリズム1は、その断面2等辺三角形の頂角の2等分線が結像レンズ3の光軸に一致し、2等辺三角形の頂点で構成する稜部(面2a、2bの交差部)が上下方向に結像レンズ3の光軸と直交し、断面2等辺三角形の底辺で構成する面(面2c)が結像レンズ3の光軸に直交するように配設されている。ここで、光学素子はプリズム1および結像レンズ3から構成されている。そして、撮像素子13として鏡像CCDを用いている。即ち、この鏡像CCDは受光した画像信号を左右反転して出力する信号変換手段としても機能する。

【0015】このように構成されたカメラ100の動作について説明する。右方向(図1において右方向)からの外部光5aは入射窓4aを通過してハウジングとしての外箱4内に入射し、プリズム1に到る。そして、外部光5aは、面2aを透過してプリズム1内に入射し、面2bにて内面反射され、面2cを透過してプリズム1から出る。プリズム1から出た外部光5aは、結像レンズ3に入射し、撮像素子13の撮像面の右半分に倒立鏡像を結ぶ。一方、左方向(図1において左方向)からの外部光5bは入射窓4bを通過して外箱4内に入射し、プリズム1に到る。そして、外部光5aは、面2bを透過してプリズム1内に入射し、面2aにて内面反射され、面2cを透過してプリズム1から出る。プリズム1から出た外部光5bは、結像レンズ3に入射し、撮像素子13の撮像面の左半分に倒立鏡像を結ぶ。

【0016】このカメラ100を車両用周辺視認装置に適用する場合、このカメラ100は結像レンズ3の光軸が水平となり、プリズム1の面2a、2bの交差部である稜部が前方を向くように、車両の前部バンパーに取り付けられる。そして、撮像素子13の出力が表示手段としてのモニタテレビに入力されるように、カメラ100とモニタテレビとが接続される。そして、撮像素子13の撮像面の右半分には、車両の右方向から入射した外部光5aによる倒立鏡像が結像され、撮像素子13の撮像面の左半分には、車両の左方向から入射した外部光5bによる倒立鏡像が結像される。この撮像素子13で受光した倒立鏡像の画像信号は、左右反転して倒立正像の画像信号に変換されて撮像素子13から出力され、天地逆となるようにモニタテレビに表示される。そこで、図2に示されるように、モニタテレビ8の右画面8aには、

右方向からの外部光5aによる正立正像が、左画面8bには左方向からの外部光5bによる正立正像がそれぞれ表示される。そして、運転者がモニタテレビ8の画面から左右の死角の状況を確認できるようになる。

【0017】このように、この実施の形態1によれば、断面2等辺三角形の角柱体に成形されたプリズム1を結像レンズ3の前段に配設し、面2aから入射する外部光5aによる倒立鏡像を撮像素子13の面2a側の領域に結像させ、面2bから入射する外部光5bによる倒立鏡像を撮像素子13の面2b側の領域に結像させるようにしているので、外部光の反射が1回のみとなり、構成の簡略化が図られ、小型で安価なカメラが得られる。また、このカメラ100を車両に搭載することにより、モニタテレビ8の右画面に右方向からの外部光による正立正像が表示され、左画面に左方向からの外部光による正像が表示されて、モニタテレビ8の画面表示方向が入射方向と一致した運転者に見やすい画像の車両用周辺視認装置が得られる。

【0018】実施の形態2. 上記実施の形態1では、外部光5a、5bをそれぞれ1回反射して結像レンズ3に導く光学素子としてプリズム1を用いるものとしているが、この実施の形態2では、図3に示すように、2枚のハーフミラー12a、12bを用いるものとしている。このハーフミラー12a、12bは結像レンズ3の前段に、各先端を一致させ、後端間を離して、結像レンズ3の光軸に対して左右対称に配設されている。

【0019】このように構成されたカメラ101では、右方向(図3において右方向)からの外部光5aは入射窓4aを通過して外箱4内に入射し、ハーフミラー12aに到る。そして、外部光5aは、ハーフミラー12aを透過し、ハーフミラー12bにて反射され、結像レンズ3に入射し、撮像素子13の撮像面の右半分に倒立鏡像を結ぶ。一方、左方向(図3において左方向)からの外部光5bは入射窓4bを通過して外箱4内に入射し、ハーフミラー12bに到る。そして、外部光5bは、ハーフミラー12bを透過し、ハーフミラー12aにて反射され、結像レンズ3に入射し、撮像素子13の撮像面の左半分に倒立鏡像を結ぶ。

【0020】従って、この実施の形態2によるカメラ101においても、上記実施の形態1と同様の効果が得られる。また、このカメラ101を適用した車両用周辺視認装置においても、上記実施の形態1と同様の効果が得られる。

【0021】実施の形態3. この実施の形態3では、プリズム1の面2a、2bにハーフミラーコートを施すものとしている。なお、他の構成は上記実施の形態1と同様に構成されている。

【0022】この実施の形態3によれば、面2a、2bにハーフミラーコートが施されているので、プリズム1の硝材の屈折率に拘わらず、面2a、2bにおける所定



の反射率を得ることができる。そこで、プリズム1の硝材として、屈折率は低い、安価で成形性に優れたPMMA等の光学材料を用いることができ、低コスト化を図ることができる。また、この実施の形態3によるカメラを車両用周辺視認装置に適用しても、上記実施の形態1と同様の効果が得られる。

【0023】実施の形態4. この実施の形態4では、面2a、2b、2cのなす角度が60度である断面正三角形の角柱体に成形されたプリズム1Aを用いるものとしている。なお、他の構成は上記実施の形態1と同様に構成されている。

【0024】一般に、プリズムを結像レンズ3の前段に配設した場合、光の分散に起因して得られる画像に色にじみが発生してしまう。しかしながら、この実施の形態4によれば、プリズム1が断面正三角形の角柱体に成形されているので、プリズム1Aが光学性能上平行平板と同等のものとなり、色にじみが発生せず、高画質の像を得ることができる。また、この実施の形態4によるカメラを車両用周辺視認装置に適用すれば、高画質のモニタテレビ画像が得られるので、運転者が死角の状況をより認識しやすくなる。

【0025】以下に、プリズム1Aが光学性能上平行平板と同等のものとなる理由について、図4に基づいて説明する。図4において、外部光5aの面2bに対して対称な光線を外部光5a<sub>1</sub>とし、面2aの面2bに対して対称な面を面2a<sub>1</sub>とする。この時、面2bで反射する外部光5aは、面2bを透過する外部光5a<sub>1</sub>に置き換えても、光学性能上は同等である。そして、面2a<sub>1</sub>と面2cとは平行となることから、外部光5a<sub>1</sub>は2つの面2a<sub>1</sub>、2cからなる平行平板を透過することになる。つまり、外部光5aは2つの面2a<sub>1</sub>、2cからなる平行平板を透過することと光学性能上同等となる。

【0026】実施の形態5. この実施の形態5では、図5に示すように、面2a、2bのなす角度が60度であり、面cをレンズ面である球面とする断面扇形の角柱体に成形されたプリズム1Bを用いるものとしている。なお、他の構成は上記実施の形態1と同様に構成されてい\*

$$N \cdot \sin \theta_1 = \sin \theta$$

$$60^\circ - \theta_1 \geq \sin^{-1}(1/N)$$

$$60^\circ - \sin^{-1}(\sin \theta / N) \geq \sin^{-1}(1/N) \quad (3)$$

但し、 $\theta$  : 結像レンズの画角(半角)

N : プリズムの硝材の屈折率

$\theta_1$  : プリズムの面2cに対する入射角

ここで、一例として、結像レンズ3の画角 $\theta$ を30度とすれば、プリズム1Aの屈折率Nは1.52753以上であればよい。

【0029】なお、上記実施の形態6では、上記実施の形態4におけるプリズム1Aについて説明しているが、上述の式(3)における $\theta$ (結像レンズの画角)を上記実施の形態5におけるプリズム1Bのレンズ成分である

\*る。この実施の形態5によるプリズム1Bは、図6に示されるように、断面正三角形の角柱体に成形されたプリズム1aと、プリズム1a側の内面が平面で、かつ、外面が球面に成形されたプリズム1bとの合成体と考えられる。そこで、この実施の形態5のカメラ102によれば、プリズム1aにより、上記実施の形態4と同様に、色にじみの発生を防止でき、高画質の像が得られる。さらに、プリズム1bがレンズ機能を有することから、結像レンズ3を簡素化あるいは省略することができる。また、この実施の形態5によるカメラを車両用周辺視認装置に適用しても、上記実施の形態1と同様の効果が得られる。

【0027】実施の形態6. この実施の形態6は、上記実施の形態4における断面正三角形の角柱体に成形されたプリズム1Aの硝材の屈折率を規定するものである。つまり、右方向からの外部光5aがプリズム1Aの面2aを透過した後、面2bへの入射角が臨界角以上となるように、かつ、左方向からの外部光5bがプリズム1Aの面2bを透過した後、面2aへの入射角が臨界角以上となるように硝材の屈折率を規定するものである。この実施の形態6によれば、外部光5a、5bがそれぞれ面2b、2aで全反射されるので、外部光5a、5bの光量を損失することなく結像レンズ3に入射でき、高画質の像が得られる。また、この実施の形態6によるカメラを車両用周辺視認装置に適用すれば、高画質のモニタテレビ画像が得られるので、運転者が死角の状況をより認識しやすくなる。

【0028】ここで、面2aへの入射角が臨界角以上となる硝材の屈折率Nについて図7に基づいて説明する。プリズム1Aの面2cにおける屈折は、スネル(Snell)の定理により式(1)で表される。この時、 $\theta$ は結像レンズ3の画角(半角)、 $\theta_1$ は面2cに対する入射角である。そこで、プリズム1の面2bに対する入射角は $60^\circ - \theta_1$ となり、面2bで全反射する条件は、式(2)で表される。よって、式(1)、式(2)から式(3)が得られる。そこで、式(3)を満足する屈折率の硝材を用いてプリズム1Aを作製すればよい。

$$(1)$$

$$(2)$$

$$(3)$$

プリズム1bと結像レンズ3とを合成した撮像画角と考ええると、上記実施の形態5にも適用できることがわかる。

【0030】実施の形態7. この実施の形態7では、図8に示すように、プリズム1を外箱4と一体に構成するものとしている。なお、他の構成は上記実施の形態1と同様に構成されている。

【0031】このように構成されたカメラ103は、プリズム1が外箱4と一体に構成されているので、装置の小型化が図られる。また、この実施の形態7によるカメ

ラ103を車両用周辺視認装置に適用すれば、外箱4の容積を小さくでき、その分装置の小型化が図れる。

【0032】なお、上記実施の形態7では、実施の形態1においてプリズム1を外箱4と一体に構成するものとしているが、他の実施の形態に適用してもよい。

【0033】実施の形態8. この実施の形態8では、図9に示すように、モニタテレビ8に表示される画像の右画像8aと左画像8bとの境界に境界線19を表示させるものである。なお、車両に搭載されるカメラは上記各実施の形態におけるカメラのいずれかを用いるものとする。そして、この実施の形態8では、境界線19を表示する手段としては、カメラ回路10上にて映像信号上に線の信号を追加して出力するようにしている。従って、運転者に見やすい画像が得られる車両用周辺視認装置が得られる。

【0034】なお、上記実施の形態8では、境界線19を表示する手段としては、カメラ回路10上にて映像信号上に線の信号を追加して出力するようにするものとしているが、モニタテレビ8の回路10上にて線の信号を追加してもよく、モニタテレビ8の画面上に線を描いてもよい。

【0035】実施の形態9. 上記実施の形態8では、境界線19を表示する手段としては、カメラ回路10上にて映像信号上に線の信号を追加して出力するようにしているが、この実施の形態9では、図10に示すように、プリズム1Aの稜部を面取りし、その面取り部14に遮光部材として墨15を塗布するものとしている。この実施の形態9では、撮像素子13上に左右方向からの外部光5a、5bによる倒立鏡像とともに面取り部14の像が結像されるので、モニタテレビ8の右画像8aと左画像8bとの境界に境界線19が表示される。従って、この実施の形態9によるカメラにおいても、上記実施の形態8と同様の効果が得られる。また、この実施の形態9によるカメラを車両用周辺視認装置に適用すれば、モニタテレビ画面上に表示される左右の画像間に境界線19が表示されるので、運転者が死角の状況を認識しやすくなる。

【0036】なお、上記各実施の形態では、撮像素子13として鏡像CCDを用いて、撮像素子13の撮像面上に結像された鏡像の画像信号を左右反転して正像の画像信号に変換して出力するものとしている。しかしながら、鏡像の画像信号を左右反転して正像の画像信号に変換する新語変換手段としては、鏡像CCDに限らず、画像信号を左右反転するものであればよく、例えば画像の\*

$$60^\circ - \sin^{-1} \{ \sin(\theta/N) \} \geq \sin^{-1}(1/N) \quad \text{式(3)}$$

(但し、 $\theta$ は撮像面角(半角)である)

また、上記プリズムの断面2等辺三角形の頂点を挟む2面にハーフミラーコートが施されているので、プリズムの材料に屈折率の低い硝材を用いることができ、その分低コスト化が図られる。また、上記プリズムは、上記ハウジングに一体の構成され、該プリズムの2等辺三角形の頂点を挟む2辺で構成される面をそれぞれ上記入射窓

\*左右が反転する鏡像モニタテレビや画像信号を左右反転処理する演算処理回路を用いることができる。さらには、運転者が通常のモニタテレビの画面を鏡で反射させて観察するようにしてもよい。

【0037】また、上記各実施の形態では、外箱4に左右方向から入射してくる外部光5a、5bによる倒立鏡像を撮像素子13の撮像面上の左右に同時に結像するものとして説明している。しかしながら、本願のカメラは、撮像素子13の撮像面上に結像させるための外部光は外箱4に左右方向から入射してくる光に限定されるものではなく、カメラの姿勢を変えることにより、外箱4を挟んで相対する2方向から入射してくる外部光による倒立鏡像を1回の反射により撮像素子13上に同時に結像できるものである。

【0038】

【発明の効果】この発明は、以上のように構成されているので、以下に記載されるような効果を奏する。

【0039】この発明によれば、両側にそれぞれ外部光を取り入れる入射窓が設けられたハウジングと、このハウジング内に配設された撮像素子と、一側の入射窓から入射する外部光を1回反射して、該撮像素子の撮像面の該一側の入射窓側の領域に該外部光による倒立鏡像を結像するとともに、他側の入射窓から入射する外部光を1回反射して、該撮像素子の撮像面の該他側の入射窓側の領域に該外部光による倒立鏡像を結像する光学素子とを備えているので、外部光の反射が1回のみとなり、構成の簡素化が図られ、小型で安価なカメラが得られる。

【0040】また、上記光学素子は、上記撮像素子の前段に配設されて外部光を該撮像素子の撮像面上に結像する結像レンズと、断面形状が2等辺三角形の角柱体に成形され、該2等辺三角形の頂角の2等分線を該結像レンズの光軸に一致させて、該結像レンズの前段に配設されたプリズムとから構成されているので、光学素子の構成の簡素化が図られる。また、上記プリズムは、断面2等辺三角形の底辺で構成される面がレンズ面に形成されているので、結像レンズの簡略化が図られる。また、上記プリズムは、断面2等辺三角形の頂角が60度に構成されているので、色にじみの発生が抑えられ、高画質の画像が得られる。また、上記プリズムは、下式(3)で規定される屈折率Nを有するので、外部光の光量の損失がなく、高画質の画像が得られる。

として機能するようにしたので、装置の小型化が図られる。また、上記プリズムは、面取り部が2等辺三角形の頂点で構成する稜部に形成され、遮光部材が該面取り部に設けられているので、特別な信号処理をすることなく、撮像素子の撮像面に結像される画像間の境界線が得られる。また、上記光学素子は、上記撮像素子の前段に配設されて外部光を該撮像素子の撮像面上に結像する結

像レンズと、該結像レンズの前端に、互いに所定の角度をなして該結像レンズの光軸に対して対称に配設された一対のハーフミラーとから構成されているので、光学素子の構成の簡略化が図られ、さらに低コスト化が図られる。

【0041】この発明によれば、車両の前部に取り付けられ、該車両の進行方向の左右の両側にそれぞれ外部光を取り入れる入射窓が設けられたハウジングと、このハウジング内に撮像面を該車両の前方側に面するように配設された撮像素子と、左側の入射窓から入射する外部光を1回反射して、該撮像素子の撮像面の左側の領域に該外部光による倒立鏡像を結像するとともに、右側の入射窓から入射する外部光を1回反射して、該撮像素子の撮像面の右側の領域に該外部光による倒立鏡像を結像する光学素子と、該撮像面に結像された倒立鏡像の画像信号を左右反転して倒立正像の画像信号に変換する信号変換手段と、該信号変換手段からの倒立正像の画像信号を入力して正立正像を表示する表示手段とを備えているので、表示手段の右画面に右方向からの外部光による正立正像が表示され、左画面に左方向からの外部光による正\*

$$60^\circ - \sin^{-1} \{ \sin(\theta/N) \} \geq \sin^{-1}(1/N) \quad \text{式(3)}$$

(但し、 $\theta$ は撮像画角(半角)である)

また、下記プリズムの断面2等辺三角形の頂点を挟む2面にハーフミラーコートが施されているので、プリズムの材料に屈折率の低い硝材を用いることができ、その分低コスト化が図られる。また、上記プリズムは、上記ハウジングに一体の構成され、該プリズムの2等辺三角形の頂点を挟む2辺で構成される面をそれぞれ上記入射窓として機能するようにしたので、装置の小型化が図られる。また、上記プリズムは、面取り部が2等辺三角形の頂点で構成する稜部に形成され、遮光部材が該面取り部に設けられているので、特別な信号処理を行うことなく撮像素子の撮像面に結像される画像間の境界線が表示され、運転者に見やすい画像表示が得られる。また、上記光学素子は、上記撮像素子の前端に配設されて外部光を該撮像素子の撮像面上に結像する結像レンズと、該結像レンズの前端に、互いに所定の角度をなして該結像レンズの光軸に対して対称に配設された一対のハーフミラーとから構成されているので、光学素子の構成の簡略化が図られる。また、上記撮像素子は、撮像面に結像された倒立鏡像の画像信号を左右反転して出力するようにし、信号変換手段としての機能を有するので、特別な信号変換手段を設ける必要がなく、装置の小型化および低コスト化が図られる。

【図面の簡単な説明】

【図1】 この発明の実施の形態1に係るカメラを示す断面図である。

【図2】 この発明の実施の形態1に係るカメラを搭載した車両用周辺視認装置におけるモニタテレビの画面表示を示す正面図である。

\*立正像が表示されて、画面表示方向が外部光の入射方向と一致した運転者に見やすい画面の車両用周辺視認装置が得られる。

【0042】また、上記光学素子は、上記撮像素子の前端に配設されて外部光を該撮像素子の撮像面上に結像する結像レンズと、断面形状が2等辺三角形の角柱体に成形され、該2等辺三角形の頂角の2等分線を該結像レンズの光軸に一致させて、該結像レンズの前端に配設されたプリズムとから構成されているので、光学素子の構成の簡略化が図られる。また、上記プリズムは、断面2等辺三角形の底辺で構成される面がレンズ面に形成されているので、結像レンズの簡略化あるいは省略化が図られ、その分小型化が可能となる。また、上記プリズムは、断面2等辺三角形の頂角が60度に構成されているので、色にじみの発生が抑えられ、運転者に認識しやすい、高画質の画像表示が得られる。また、上記プリズムは、下式(3)で規定される屈折率Nを有するので、外部光の光量の損失がなくなり、運転者に認識しやすい、高画質の画像表示が得られる。

【図3】 この発明の実施の形態2に係るカメラを示す断面図である。

【図4】 この発明の実施の形態4に係るカメラにおけるプリズム部光線面図である。

【図5】 この発明の実施の形態5に係るカメラを示す断面図である。

【図6】 この発明の実施の形態5に係るカメラにおけるプリズム部を説明する図である。

【図7】 この発明の実施の形態6に係るカメラにおけるプリズム部光線面図である。

【図8】 この発明の実施の形態7に係るカメラを示す断面図である。

【図9】 この発明の実施の形態8に係るカメラを搭載した車両用周辺視認装置におけるモニタテレビの画面表示を示す正面図である。

【図10】 この発明の実施の形態9に係るカメラにおけるプリズム部を示す斜視図である。

【図11】 従来の車両用周辺視認装置を搭載した車両の動作を説明する図である。

【図12】 従来の車両用周辺視認装置におけるモニタテレビの画面表示を示す正面図である。

【図13】 従来のカメラの一例を示す断面図である。

【図14】 従来のカメラを搭載した車両用周辺視認装置におけるモニタテレビの画面表示を示す正面図である。

【図15】 従来のカメラの他の例を示す断面図である。

【図16】 従来のカメラを搭載した車両用周辺視認装置におけるモニタテレビの画面表示を示す正面図であ

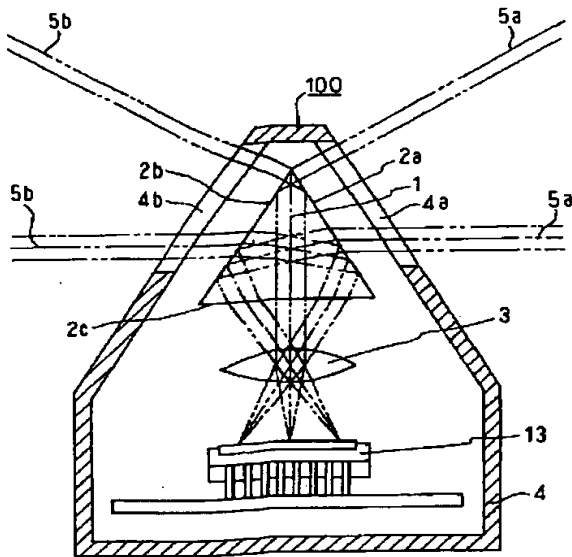
る。

【符号の説明】

1、1A、1B プリズム(光学素子)、3 結像レンズ(光学素子)、4 外箱(ハウジング)、4a、4b 入射窓、5a、5b 外部光、8 モニタテレビ(表示

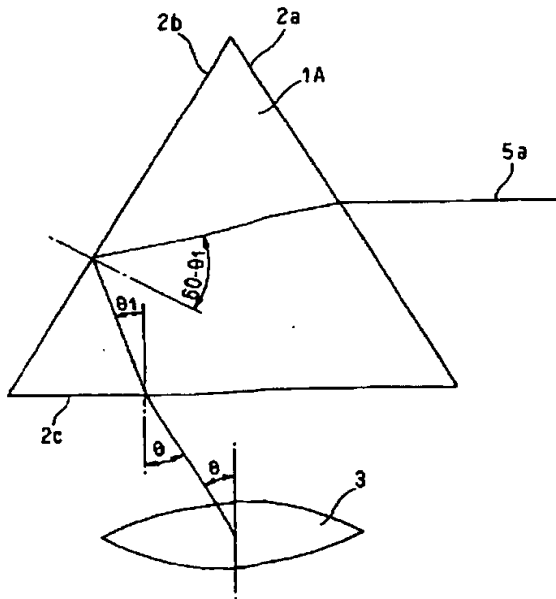
手段)、12a、12b ハーフミラー(光学素子)、13 撮像素子、14 面取り部、15 墨(遮光部材)、19 境界線、100、101、102、103 カメラ。

【図1】

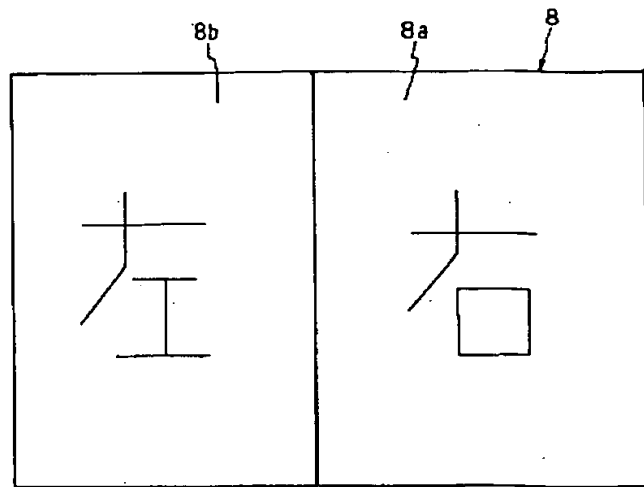


- 1: プリズム(光学素子)  
3: 結像レンズ(光学素子)  
4: 外箱(ハウジング)  
4a、4b: 入射窓  
5a、5b: 外部光  
13: 撮像素子  
100: カメラ

【図7】

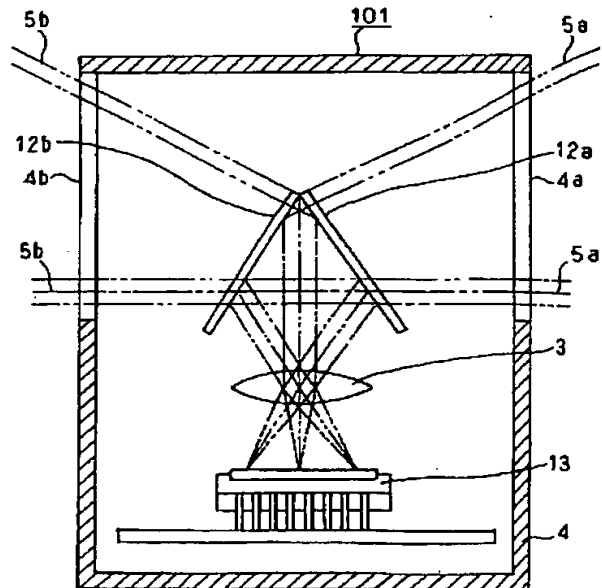


【図2】



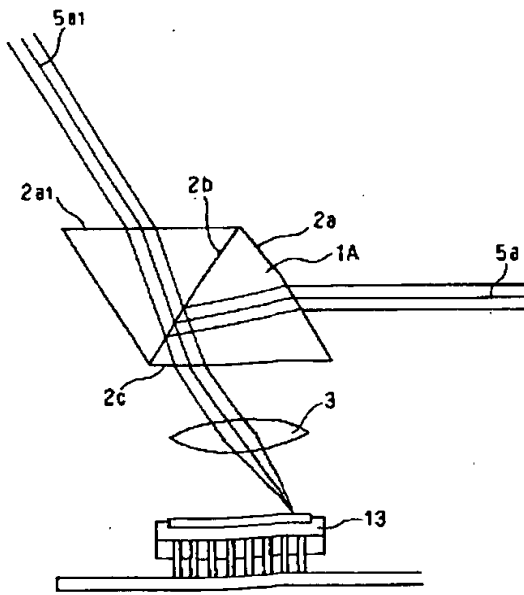
8: モニタテレビ(表示手段)

【図3】



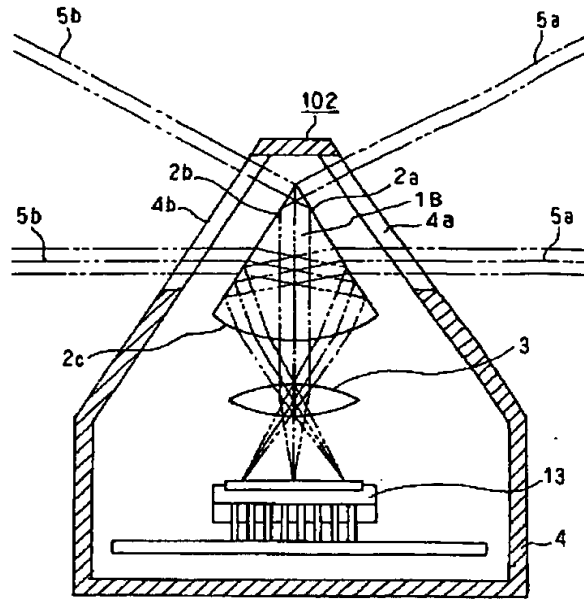
12a、12b: ハーフミラー(光学素子)  
101: カメラ

【図4】

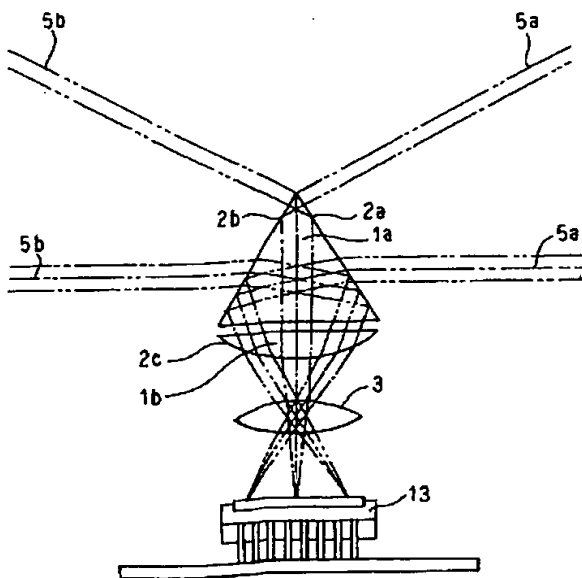


1A: プリズム (光学素子)

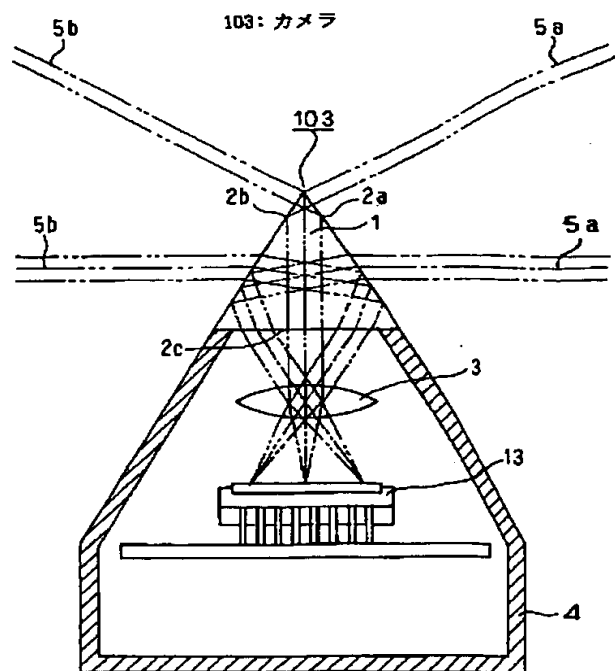
【図5】

1B: プリズム (光学素子)  
102: カメラ

【図6】

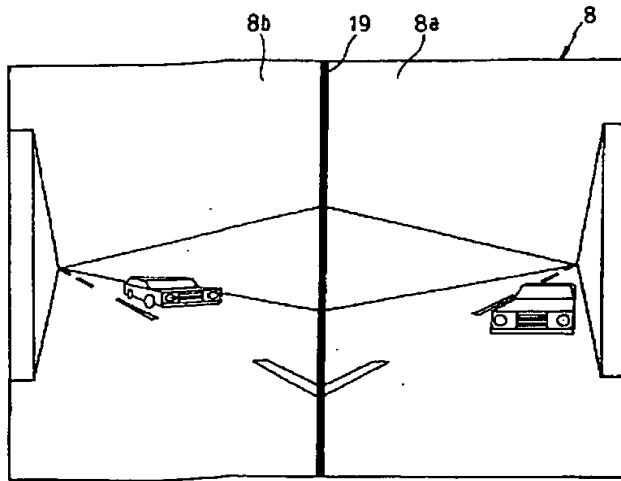


【図8】



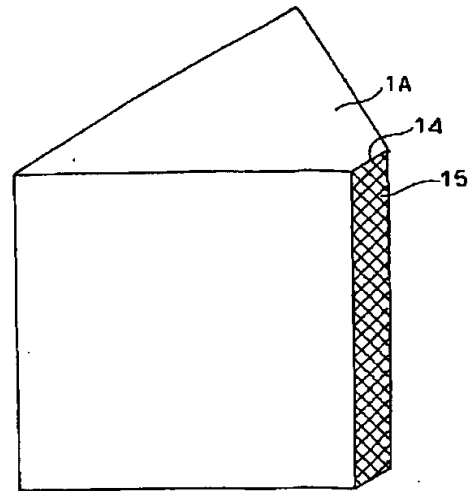
103: カメラ

【図9】

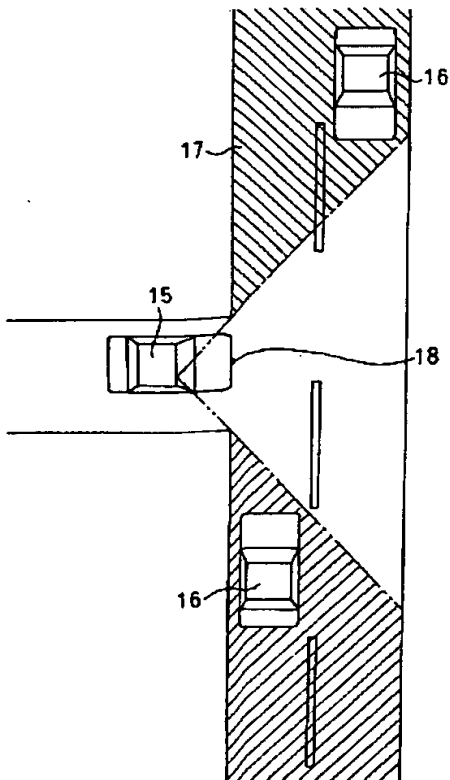


19: 境界線

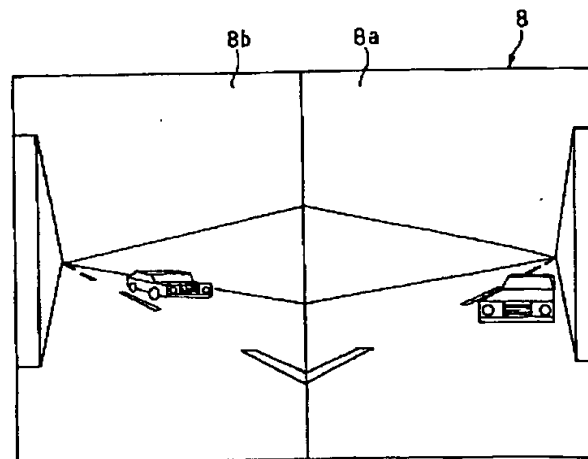
【図10】

14: 面取り部  
15: 曇(遮光)部材

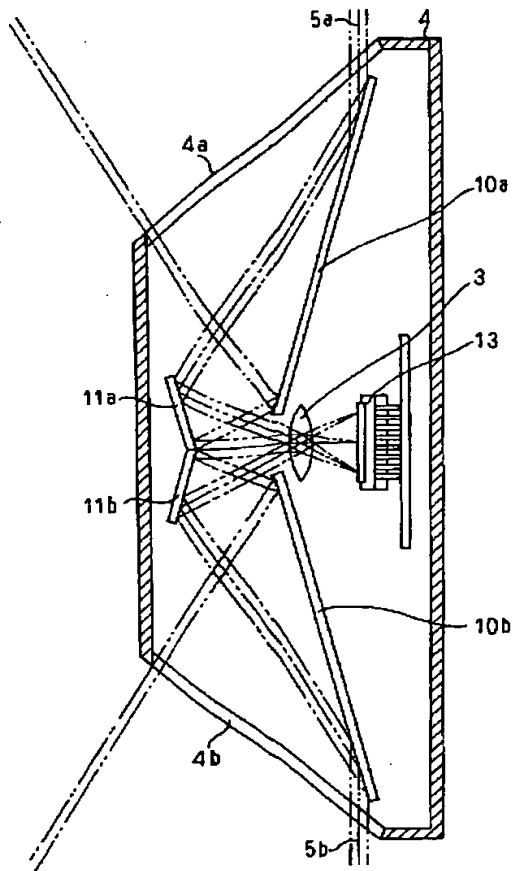
【図11】



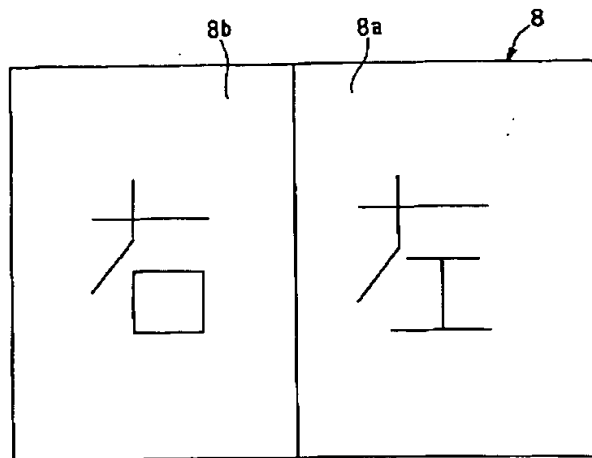
【図12】



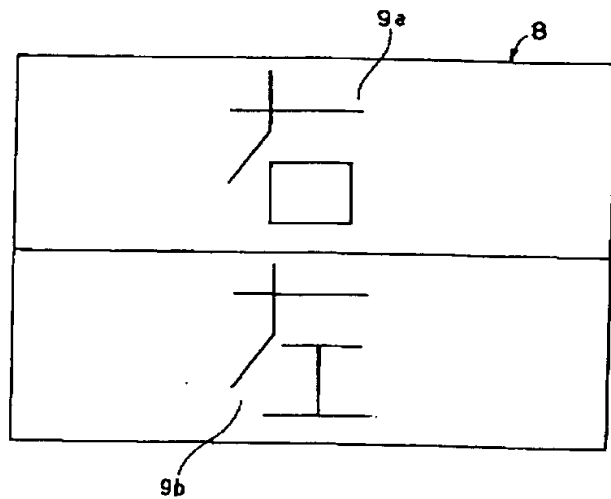
【図13】



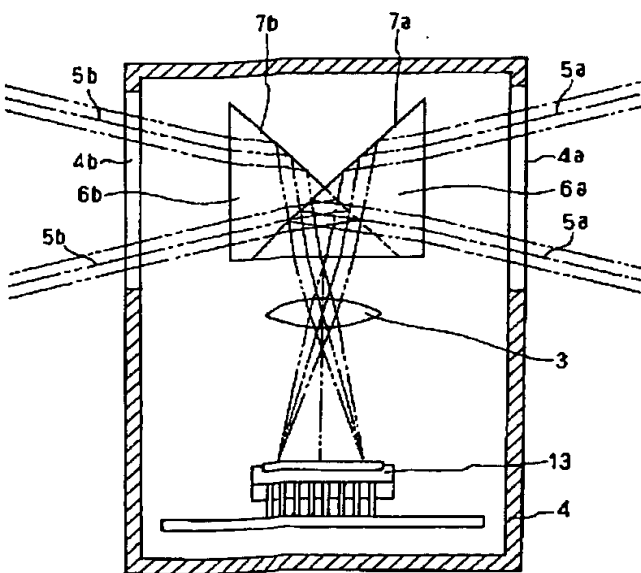
【図14】



【図16】



【図15】



## PATENT ABSTRACTS OF JAPAN

(11)Publication number : 10-229512

(43)Date of publication of application : 25.08.1998

(51)Int.Cl.

H04N 5/225  
B60R 1/00

(21)Application number : 09-030264

(71)Applicant : MITSUBISHI ELECTRIC CORP

(22)Date of filing : 14.02.1997

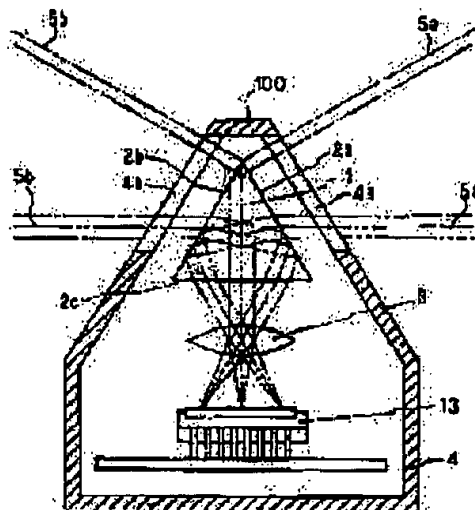
(72)Inventor : SAKATA KAZUKI

### (54) CAMERA AND VEHICLE USE SURROUNDING VISION DEVICE USING IT

#### (57)Abstract:

**PROBLEM TO BE SOLVED:** To obtain a small sized inexpensive camera applicable to a vehicle use surrounding vision device by which a driver easily views the surroundings.

**SOLUTION:** A prism 1 is placed to a pre-stage of an image forming lens 3. An external light 5a made incident from an incident window 4a is reflected on a face 2b of the prism 1 and led to the image forming lens 3. Then the external light 5a led to the image forming lens 3 is formed in an area of the incident window 4a side of the image forming face of an image pickup element 13 as an inverted mirror image. On the other hand, an external light 5b made incident from an incident window 4b is reflected on a face 2a of the prism 1 and led to the image forming lens 3. Then the external light 5b led to the image forming lens 3 is formed in an area of the incident window 4b side of the image pickup face of the image pickup element 13 as an inverted mirror image.



#### LEGAL STATUS

[Date of request for examination]

08.02.2001

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

Copyright (C); 1998,2003 Japan Patent Office



**\* NOTICES \***

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

**CLAIMS**

---

**[Claim(s)]**

[Claim 1] The camera characterized by providing the following. Housing with which the entrance window which takes in an extraneous light, respectively was prepared in both sides. The image pck-up element arranged in this housing. The optical element which reflects once the extraneous light which carries out incidence from the entrance window of the side else, and carries out image formation of the handstand mirror image by this extraneous light to the field by the side of the entrance window of the side other than [ this ] the image pck-up side of the aforementioned image pck-up element while reflecting once the extraneous light which carries out incidence from the entrance window of an unilateral and carrying out image formation of the handstand mirror image by this extraneous light to the field by the side of the entrance window of this unilateral of the image pck-up side of the aforementioned image pck-up element.

[Claim 2] The above-mentioned optical element is a camera according to claim 1 characterized by to consist of an image-formation lens which is arranged by the preceding paragraph of the above-mentioned image pck-up element, and carries out image formation of the extraneous light on the image pck-up side of this image pck-up element, and prism with which the cross-section configuration was fabricated by the prism object of two equilateral triangles, made two bisectrices of the vertical angle of these two equilateral triangles in agreement with the optical axis of the aforementioned image formation lens, and was arranged by the preceding paragraph of this image formation lens.

[Claim 3] The above-mentioned prism is a camera according to claim 2 characterized by forming in a lens side the field which consists of bases of cross-section 2 equilateral triangle.

[Claim 4] The above-mentioned prism is a camera according to claim 2 or 3 characterized by the vertical angle of cross-section 2 equilateral triangle being constituted by 60 degrees.

[Claim 5] The above-mentioned prism is a camera according to claim 2 to 4 characterized by having the refractive index  $N$  specified by the lower formula (3).

$60 \text{ degree-Sin-1} \{ \text{Sin}(\theta/N) \} \geq \text{Sin-1} (1/N)$  Formula (3)

(However,  $\theta$  is an image pck-up field angle (half size))

[Claim 6] The camera according to claim 2 to 4 characterized by giving the one-way mirror coat to the 2nd page which faces across the vertex of cross-section 2 equilateral triangle of the above-mentioned prism.

[Claim 7] The above-mentioned prism is a camera according to claim 2 to 6 characterized by making the field which one is constituted by the above-mentioned housing and consists of two sides which face across the vertex of two equilateral triangles of this prism function as the above-mentioned entrance window, respectively.

[Claim 8] The above-mentioned prism is a camera according to claim 2 to 7 characterized by being formed in the arris part which a chamfer constitutes from a vertex of two equilateral triangles, and preparing the shading member in this chamfer.

[Claim 9] The above-mentioned optical element is a camera according to claim 1 characterized by consisting of an image formation lens which is arranged by the preceding paragraph of the above-mentioned image pck-up element, and carries out image formation of the extraneous light on the image pck-up side of this image pck-up element, and a one-way mirror of the couple which made the predetermined angle mutually in the preceding paragraph of the aforementioned image formation lens, and was symmetrically arranged to the optical axis of this image formation lens.

[Claim 10] Peripheral-vision private seal equipment for vehicles characterized by providing the following. Housing with which the entrance window which is attached in the anterior part of vehicles and takes in an extraneous light on both sides of right and left of the travelling direction of these vehicles, respectively was prepared. The image pck-up element arranged so that an image pck-up side might be faced in this housing at the front side of the aforementioned vehicles. The optical element which reflects once the extraneous light which carries out incidence from a right-hand side entrance window, and carries out image formation of the handstand mirror image by this extraneous light to the field on the right-hand side of the image pck-up side of the aforementioned image pck-up element while reflecting

once the extraneous light which carries out incidence from a left-hand side entrance window and carrying out image formation of the handstand mirror image by this extraneous light to the field on the left-hand side of the image pck-up side of the aforementioned image pck-up element. A signal transformation means to carry out right-and-left reversal of the picture signal of the handstand mirror image by which image formation was carried out to the aforementioned image pck-up side, and to change into the picture signal of a handstand normal image, and a display means to input the picture signal of the handstand normal image from the aforementioned signal transformation means, and to display an erect normal image.

[Claim 11] The image formation lens which the above-mentioned optical element is arranged by the preceding paragraph of the above-mentioned image pck-up element, and carries out image formation of the extraneous light on the image pck-up side of this image pck-up element, Peripheral-vision private seal equipment for vehicles according to claim 10 characterized by consisting of prism with which the cross-section configuration was fabricated by the prism object of two equilateral triangles, made two bisectrices of the vertical angle of these two equilateral triangles in agreement with the optical axis of the aforementioned image formation lens, and was arranged by the preceding paragraph of this image formation lens.

[Claim 12] The above-mentioned prism is peripheral-vision private seal equipment for vehicles according to claim 11 characterized by forming in a lens side the field which consists of bases of cross-section 2 equilateral triangle.

[Claim 13] The above-mentioned prism is peripheral-vision private seal equipment for vehicles according to claim 11 or 12 characterized by the vertical angle of cross-section 2 equilateral triangle being constituted by 60 degrees.

[Claim 14] The above-mentioned prism is peripheral-vision private seal equipment for vehicles according to claim 11 to 13 characterized by having the refractive index  $N$  specified by the lower formula (3).

60 degree- $\sin^{-1} \{ \sin(\theta/N) \} \geq \sin^{-1} (1/N)$  Formula (3)

(However,  $\theta$  is an image pck-up field angle (half size))

[Claim 15] Peripheral-vision private seal equipment for vehicles according to claim 11 to 13 characterized by giving the one-way mirror coat to the 2nd page which faces across the vertex of cross-section 2 equilateral triangle of the above-mentioned prism.

[Claim 16] The above-mentioned prism is peripheral-vision private seal equipment for vehicles according to claim 11 to 15 characterized by making the field which one is constituted by the above-mentioned housing and consists of two sides which face across the vertex of two equilateral triangles of this prism function as the above-mentioned entrance window, respectively.

[Claim 17] The above-mentioned prism is peripheral-vision private seal equipment for vehicles according to claim 11 to 16 characterized by being formed in the arris part which a chamfer constitutes from a vertex of two equilateral triangles, and preparing the shading member in this chamfer.

[Claim 18] The above-mentioned optical element is peripheral-vision private seal equipment for vehicles according to claim 10 characterized by consisting of an image formation lens which is arranged by the preceding paragraph of the above-mentioned image pck-up element, and carries out image formation of the extraneous light on the image pck-up side of this image pck-up element, and a one-way mirror of the couple which made the predetermined angle mutually in the preceding paragraph of the aforementioned image formation lens, and was symmetrically arranged to the optical axis of this image formation lens.

[Claim 19] The above-mentioned image pck-up element is peripheral-vision private seal equipment for vehicles according to claim 10 to 18 characterized by carrying out right-and-left reversal, making it output the picture signal of the handstand mirror image by which image formation was carried out to an image pck-up side, and having a function as a signal transformation means.

---

[Translation done.]

\* NOTICES \*

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

DETAILED DESCRIPTION

---

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the peripheral-vision private seal equipment for vehicles using the camera and it which can picturize the direction of plurality simultaneously.

[0002]

[Description of the Prior Art] Drawing 11 is drawing showing operation of vehicles which carried the conventional peripheral-vision private seal equipment for vehicles to explain. Generally, when vehicles 15 tend to go into a crossing, the field shown to an operator with a slash at drawing 11 will become a dead angle 17. And an operator cannot check by looking other vehicles 16 which exist in the dead angle 17 of these right and left. Then, in order to make an operator check the situation of a dead angle 17 by looking, a camera 18 is attached in anterior part covering of vehicles, the dead angle 17 on either side is simultaneously photoed with this camera 18, and the peripheral-vision private seal equipment for vehicles which displays the picture of a dead angle 17 as shown in drawing 12 on the screen of a monitor TV 8 is put in practical use.

[0003] Below, an example of the conventional camera is explained based on drawing 13. Entrance windows 4a and 4b are formed in right and left, and the tank 4 as housing has come to be able to carry out incidence of the extraneous light on either side. And the image formation lens 3 is attached in a tank 4, and the image pck-up element 13 which consisted of CCD is arranged in the focal position of the image formation lens 3. Moreover, the 1st mirror 10a and 10b of a couple is arranged in right and left of the image formation lens 3. Furthermore, the 2nd mirror 11a and 11b of a couple faces the 1st mirror 10a and 10b of a couple, and is arranged.

[0004] Thus, through entrance window 4a, in a tank 4, incidence is carried out, it is first reflected by 1st mirror 10a, and, subsequently extraneous light 5a from the right (it sets to drawing 13 and is above) is reflected by 2nd mirror 11a in constituted camera 18A. Extraneous light 5a reflected by this 2nd mirror 11a is led to the image formation lens 3, and connects a handstand normal image to the left half of the image pck-up side of the image pck-up element 13. On the other hand, through entrance window 4b, in a tank 4, incidence is carried out, it is first reflected by 1st mirror 10b, and, subsequently extraneous light 5b from the left (it sets to drawing 13 and is down) is reflected by 2nd mirror 11b. Extraneous light 5b reflected by this 2nd mirror 11b is led to the image formation lens 3, and connects a handstand normal image to the right half of the image pck-up side of the image pck-up element 13. Then, when this camera 18A is applied to the peripheral-vision private seal equipment for vehicles, the picture signal of the handstand normal image which received light with the image pck-up element 13 is displayed to become top-and-bottom reverse on the screen of a monitor TV. Then, as shown in drawing 12, the normal image according [ the normal image by extraneous light 5a from the right ] to extraneous light 5b from the left is displayed on right screen 8a of a monitor TV 8 by left screen 8b, respectively. And an operator can check now the situation of a dead angle on either side from the screen of a monitor TV.

[0005] In this camera 18A, the picture which turned into a mirror image by mirror 10a (10b) of reflecting extraneous light 5a (5b) twice by the 1st and 2nd mirrors 10a and 11a (10b, 11b), i.e., the 1st, is made into the normal image by 2nd mirror 11a (11b). Here, when only 1st mirror 10a (10b) is used not using 2nd mirror 11a (11b), the picture which received light with the image pck-up element 13 turns into a handstand mirror image. In this case, the mirror image CCD which carries out right-and-left reversal and outputs a light-receiving signal as an image pck-up element 13 will be used. And the picture signal of the handstand mirror image which received light carries out right-and-left reversal, and is outputted from the image pck-up element 13 as a picture signal of a handstand normal image, and it is made to display on a monitor TV that it becomes top-and-bottom reverse. Then, as shown in drawing 14, the normal image according [ the normal image by extraneous light 5b from the left ] to extraneous light 5a from the right will be displayed on left screen 8b by right screen 8a of a monitor TV 8. Consequently, the direction of a screen display of a

monitor TV will become contrary to the direction of incidence, and will become an operator with a screen hard to see. [0006] Subsequently, other examples of the conventional camera are explained based on drawing 15. This camera 18B is replaced with a reflective mirror, and is constituted like above-mentioned camera 18A except for the point using a mirror image CCD as an image pick-up element 13 using prism. That is, the prism 6a and 6b of a couple is installed up and down in the image formation lens 3 by the preceding paragraph of the image formation lens 3 side by side on both sides of a medial axis.

[0007] Thus, incidence of the extraneous light 5a from the right (it sets to drawing 15 and is the right) is carried out into a tank 4 through entrance window 4a, and it carries out incidence to prism 6a, it is reflected by reflector 7a, and it is led to the image formation lens 3, and connects a handstand mirror image with constituted camera 18B to the lower half of the image pick-up side of the image pick-up element 13. On the other hand, incidence is carried out into a tank 4 through entrance window 4b, incidence is carried out to prism 6b, it is reflected by reflector 7b, and extraneous light 5b from the left (it sets to drawing 15 and is the left) is led to the image formation lens 3, and connects a handstand mirror image to the upper half of the image pick-up side of the image pick-up element 13. In this camera 18B, since reflection is 1 time, although a miniaturization can be attained, the picture by which image formation is carried out to the image pick-up element 13 will turn into a mirror image. Then, when this camera 18B is applied to the peripheral-vision private seal equipment for vehicles, right-and-left reversal is carried out, and the picture signal of the handstand mirror image which received light with the image pick-up element 13 is outputted from the image pick-up element 13, and is displayed to become top-and-bottom reverse on the screen of a monitor TV. Then, as shown in drawing 16, the normal image according [ the normal image by extraneous light 5a from the right ] to extraneous light 5b from the left is displayed on upper screen 9a of a monitor TV 8 by lower screen 9b, respectively. And an operator can check now the situation of a dead angle on either side from the screen of a monitor TV.

[0008]

[Problem(s) to be Solved by the Invention] since camera 18A using the conventional reflective mirror is reflected twice by the 1st mirror and 2nd mirror as mentioned above -- the size of equipment -- \*\*\*\* -- the technical problem which it hears that it will become occurred On the other hand, camera 18B using two prism becomes a normal image according [ upper screen 9a of a monitor TV ] to extraneous light 5a from the right as mentioned above, and lower screen 9b becomes a normal image by extraneous light 5b from the left. Then, when this camera 18B was applied to the peripheral-vision private seal equipment for vehicles, the technical problem that the screen displayed on a monitor TV will become an operator with a screen hard to see occurred. Moreover, two or more prism is need and the technical problem that low-cost-ization could not be attained also occurred.

[0009] This invention was made in order to solve the above technical problems, it makes reflection of light 1 time, attains simplification of composition and aims at obtaining a small and cheap camera. Moreover, a left screen is made to display the normal image according the normal image by the extraneous light from the right to the extraneous light from the left on the right screen of a monitor TV, and it aims at obtaining the peripheral-vision private seal equipment for vehicles with which a legible picture is acquired by the operator.

[0010]

[Means for Solving the Problem] Housing with which the entrance window which, as for the camera concerning this invention, takes in an extraneous light on both sides, respectively was prepared, While reflecting once the extraneous light which carries out incidence from the image pick-up element arranged in this housing, and the entrance window of an unilateral and carrying out image formation of the handstand mirror image by this extraneous light to the field by the side of the entrance window of this unilateral of the image pick-up side of this image pick-up element The extraneous light which carries out incidence from the entrance window of the side else is reflected once, and the field by the side of the entrance window of the side other than [ this ] the image pick-up side of this image pick-up element is equipped with the optical element which carries out image formation of the handstand mirror image by this extraneous light.

[0011] Moreover, the above-mentioned optical element consists of an image formation lens which is arranged by the preceding paragraph of the above-mentioned image pick-up element, and carries out image formation of the extraneous light on the image pick-up side of this image pick-up element, and prism which the cross-section configuration was fabricated by the prism object of two equilateral triangles, and two bisectrices of the vertical angle of these two equilateral triangles were made in agreement with the optical axis of this image formation lens, and was arranged by the preceding paragraph of this image formation lens. Moreover, the field where the above-mentioned prism consists of bases of cross-section 2 equilateral triangle is formed in the lens side. Moreover, as for the above-mentioned prism, the vertical angle of cross-section 2 equilateral triangle is constituted by 60 degrees. Moreover, the above-mentioned prism has the refractive index N specified by the lower formula (3).

60 degree-Sin-1 {Sin(theta/N)} >= Sin-1 (1-/N) Formula (3)

(However, theta is an image pck-up field angle (half size))

Moreover, the one-way mirror coat is given to the 2nd page which faces across the vertex of cross-section 2 equilateral triangle of the above-mentioned prism. Moreover, the field which one is constituted by the above-mentioned housing and consists of two sides which face across the vertex of two equilateral triangles of this prism is made for the above-mentioned prism to function as the above-mentioned entrance window, respectively. Moreover, the above-mentioned prism is formed in the arris part which a chamfer constitutes from a vertex of two equilateral triangles, and the shading member is prepared in this chamfer. Moreover, the above-mentioned optical element consists of an image formation lens which is arranged by the preceding paragraph of the above-mentioned image pck-up element, and carries out image formation of the extraneous light on the image pck-up side of this image pck-up element, and a one-way mirror of the couple which made the predetermined angle mutually in the preceding paragraph of this image formation lens, and was symmetrically arranged to the optical axis of this image formation lens.

[0012] Housing with which the entrance window which the peripheral-vision private seal equipment for vehicles concerning this invention is attached in the anterior part of vehicles, and takes in an extraneous light on both sides of right and left of the travelling direction of these vehicles, respectively was prepared, While reflecting once the extraneous light which carries out incidence of the image pck-up side from the image pck-up element arranged so that it might face at the front side of these vehicles, and a left-hand side entrance window in this housing and carrying out image formation of the handstand mirror image by this extraneous light to the field on the left-hand side of the image pck-up side of this image pck-up element The optical element which reflects once the extraneous light which carries out incidence from a right-hand side entrance window, and carries out image formation of the handstand mirror image by this extraneous light to the field on the right-hand side of the image pck-up side of this image pck-up element, It has a signal transformation means to carry out right-and-left reversal of the picture signal of the handstand mirror image by which image formation was carried out to this image pck-up side, and to change into the picture signal of a handstand normal image, and a display means to input the picture signal of the handstand normal image from this signal transformation means, and to display an erect normal image.

[0013] Moreover, the above-mentioned optical element consists of an image formation lens which is arranged by the preceding paragraph of the above-mentioned image pck-up element, and carries out image formation of the extraneous light on the image pck-up side of this image pck-up element, and prism which the cross-section configuration was fabricated by the prism object of two equilateral triangles, and two bisectrices of the vertical angle of these two equilateral triangles were made in agreement with the optical axis of this image formation lens, and was arranged by the preceding paragraph of this image formation lens. Moreover, the field where the above-mentioned prism consists of bases of cross-section 2 equilateral triangle is formed in the lens side. Moreover, as for the above-mentioned prism, the vertical angle of cross-section 2 equilateral triangle is constituted by 60 degrees. Moreover, the above-mentioned prism has the refractive index N specified by the lower formula (3).

$60 \text{ degree-Sin-1} \{ \text{Sin}(\theta/N) \} \geq \text{Sin-1} (1/N)$  Formula (3)

(However, theta is an image pck-up field angle (half size))

Moreover, the one-way mirror coat is given to the 2nd page which faces across the vertex of cross-section 2 equilateral triangle of the following prism. Moreover, the field which one is constituted by the above-mentioned housing and consists of two sides which face across the vertex of two equilateral triangles of this prism is made for the above-mentioned prism to function as the above-mentioned entrance window, respectively. Moreover, the above-mentioned prism is formed in the arris part which a chamfer constitutes from a vertex of two equilateral triangles, and the shading member is prepared in this chamfer. Moreover, the above-mentioned optical element consists of an image formation lens which is arranged by the preceding paragraph of the above-mentioned image pck-up element, and carries out image formation of the extraneous light on the image pck-up side of this image pck-up element, and a one-way mirror of the couple which made the predetermined angle mutually in the preceding paragraph of this image formation lens, and was symmetrically arranged to the optical axis of this image formation lens. Moreover, the above-mentioned image pck-up element carries out right-and-left reversal, and it is made to output the picture signal of the handstand mirror image by which image formation was carried out to an image pck-up side, and it has a function as a signal transformation means.

[0014]

[Embodiments of the Invention] Hereafter, the form of implementation of this invention is explained about drawing. Form 1. drawing 1 of operation is the cross section showing the camera concerning the form 1 of implementation of this invention, gives the same sign to the same as that of the conventional camera shown in drawing 13 and drawing 15 in drawing, or a considerable portion, and omits the explanation. With the form 1 of this operation, the prism 1 by which the cross-section configuration was fabricated by the prism object of two equilateral triangles is arranged by the preceding paragraph of the image formation lens 3. And the optical axis of the image formation lens 3 and the arris part

(intersection of Fields 2a and 2b) which two bisectrices of the vertical angle of the cross-section 2 equilateral triangle constitute from a vertex of two equilateral triangles in accordance with the optical axis of the image formation lens 3 cross at right angles in the vertical direction, and prism 1 is arranged so that the optical axis of the image formation lens 3 and the field (field 2c) constituted from a base of cross-section 2 equilateral triangle may cross at right angles. Here, the optical element consists of prism 1 and an image formation lens 3. And the mirror image CCD is used as an image pck-up element 13. That is, this mirror image CCD functions also as a signal transformation means to carry out right-and-left reversal and to output the picture signal which received light.

[0015] Thus, operation of the constituted camera 100 is explained. Through entrance window 4a, incidence of the extraneous light 5a from the right (it sets to drawing 1 and is the right) is carried out into the tank 4 as housing, and it results in prism 1. And extraneous light 5a penetrates field 2a, incidence of it is carried out into prism 1, and internal reflection is carried out in field 2b, it penetrates field 2c, and comes out of prism 1. Incidence of the extraneous light 5a which came out of prism 1 is carried out to the image formation lens 3, and it connects a handstand mirror image to the right half of the image pck-up side of the image pck-up element 13. On the other hand, through entrance window 4b, incidence of the extraneous light 5b from the left (it sets to drawing 1 and is the left) is carried out into a tank 4, and it results in prism 1. And extraneous light 5a penetrates field 2b, incidence of it is carried out into prism 1, and internal reflection is carried out in field 2a, it penetrates field 2c, and comes out of prism 1. Incidence of the extraneous light 5b which came out of prism 1 is carried out to the image formation lens 3, and it connects a handstand mirror image to the left half of the image pck-up side of the image pck-up element 13.

[0016] When applying this camera 100 to the peripheral-vision private seal equipment for vehicles, the optical axis of the image formation lens 3 becomes level, and this camera 100 is attached in the anterior part bumper of vehicles so that the arris part which is an intersection of the fields 2a and 2b of prism 1 may turn to the front. And a camera 100 and a monitor TV are connected so that the output of the image pck-up element 13 may be inputted into the monitor TV as a display means. And in the right half of the image pck-up side of the image pck-up element 13, image formation of the handstand mirror image by extraneous light 5a which carried out incidence from the right of vehicles is carried out, and image formation of the handstand mirror image by extraneous light 5b which carried out incidence from the left of vehicles is carried out to the left half of the image pck-up side of the image pck-up element 13 in it. The picture signal of the handstand mirror image which received light with this image pck-up element 13 carries out right-and-left reversal, is changed into the picture signal of a handstand normal image, and is outputted from the image pck-up element 13, and it is displayed on a monitor TV that it becomes top-and-bottom reverse. Then, as shown in drawing 2, the erect normal image according [ the erect normal image by extraneous light 5a from the right ] to extraneous light 5b from the left is displayed on right screen 8a of a monitor TV 8 by left screen 8b, respectively. And an operator can check now the situation of a dead angle on either side from the screen of a monitor TV 8.

[0017] Thus, according to the gestalt 1 of this operation, the prism 1 fabricated by the prism object of cross-section 2 equilateral triangle is arranged in the preceding paragraph of the image formation lens 3. Since it is made to make the field by the side of field 2b of the image pck-up element 13 carry out image formation of the handstand mirror image by extraneous light 5b which the field by the side of field 2a of the image pck-up element 13 is made to carry out image formation of the handstand mirror image by extraneous light 5a which carries out incidence from field 2a, and carries out incidence from field 2b Reflection of an extraneous light becomes only 1 time, simplification of composition is attained, and a small and cheap camera is obtained. Moreover, by carrying this camera 100 in vehicles, the erect normal image by the extraneous light from the right is displayed on the right screen of a monitor TV 8, the normal image by the extraneous light from the left is displayed on a left screen, and the peripheral-vision private seal equipment for vehicles of a legible picture is got by the operator whose direction of a screen display of a monitor TV 8 corresponded with the direction of incidence.

[0018] Although prism 1 shall be used with the gestalt 1 of the gestalt 2. above-mentioned implementation of operation as an optical element which reflects extraneous lights 5a and 5b once, respectively, and is led to the image formation lens 3, as shown in drawing 3, the one-way mirrors 12a and 12b of two sheets shall be used with the gestalt 2 of this operation. In the preceding paragraph of the image formation lens 3, these one-way mirrors 12a and 12b make each nose of cam in agreement, detach between the back end, and are arranged in the bilateral symmetry to the optical axis of the image formation lens 3.

[0019] Thus, through entrance window 4a, in a tank 4, incidence of the extraneous light 5a from the right (it sets to drawing 3 and is the right) is carried out, and it results with the constituted camera 101 at one-way mirror 12a. And one-way mirror 12a is penetrated, it is reflected in one-way mirror 12b, and incidence of the extraneous light 5a is carried out to the image formation lens 3, and it connects a handstand mirror image to the right half of the image pck-up side of the image pck-up element 13. On the other hand, through entrance window 4b, in a tank 4, incidence of the extraneous light 5b from the left (it sets to drawing 3 and is the left) is carried out, and it results at one-way mirror 12b.



And one-way mirror 12b is penetrated, it is reflected in one-way mirror 12a, and incidence of the extraneous light 5b is carried out to the image formation lens 3, and it connects a handstand mirror image to the left half of the image pick-up side of the image pick-up element 13.

[0020] Therefore, also in the camera 101 by the form 2 of this operation, the same effect as the form 1 of the above-mentioned implementation is acquired. Moreover, also in the circumference check-by-looking equipment for vehicles which applied this camera 101, the same effect as the form 1 of the above-mentioned implementation is acquired.

[0021] gestalt 3. of operation -- the one-way mirror coat shall be given to the fields 2a and 2b of prism 1 with the gestalt 3 of this operation. In addition, other composition is constituted like the gestalt 1 of the above-mentioned implementation.

[0022] According to the gestalt 3 of this operation, since the one-way mirror coat is given to Fields 2a and 2b, the predetermined reflection factor in Fields 2a and 2b can be obtained irrespective of the refractive index of the \*\* material of prism 1. Then, as \*\* material of prism 1, although a refractive index is low, it is cheap, and optical materials, such as PMMA excellent in the moldability, can be used, and low-cost-ization can be attained. Moreover, even if it applies the camera by the gestalt 3 of this operation to the peripheral-vision private seal equipment for vehicles, the same effect as the gestalt 1 of the above-mentioned implementation is acquired.

[0023] gestalt 4. of operation -- with the gestalt 4 of this operation, prism 1A fabricated by the prism object of the cross-section equilateral triangle whose angle which Fields 2a, 2b, and 2c make is 60 degrees shall be used. In addition, other composition is constituted like the gestalt 1 of the above-mentioned implementation.

[0024] Generally, when prism is arranged in the preceding paragraph of the image formation lens 3, color bleeding will occur in the picture acquired by originating in distribution of light. However, according to the gestalt 4 of this operation, since prism 1 is fabricated by the prism object of a cross-section equilateral triangle, prism 1A will become equivalent to an optical-character ability Kamitaira line plate, and color bleeding does not occur, but a high-definition image can be obtained. Moreover, if the camera by the gestalt 4 of this operation is applied to the peripheral-vision private seal equipment for vehicles, since a high-definition monitor TV picture will be acquired, it becomes easier for an operator to recognize the situation of a dead angle.

[0025] Below, why prism 1A will become equivalent to an optical-character ability Kamitaira line plate is explained based on drawing 4. In drawing 4, a symmetrical beam of light is made into an extraneous light five a1 to field 2b of extraneous light 5a, and a symmetrical field is made into a field two a1 to field 2b of field 2a. Even if it transposes extraneous light 5a reflected by field 2b to the extraneous light five a1 which penetrates field 2b at this time, the optical-character ability top is equivalent. And a field two a1 and field 2c will penetrate the parallel plate to which a bird clapper to the extraneous light five a1 becomes parallel from two fields two a1 and 2c. That is, extraneous light 5a becomes equivalent on two fields two a1, and penetrating the parallel plate which consists of 2c and optical-character ability.

[0026] gestalt 5. of operation -- with the gestalt 5 of this operation, as shown in drawing 5, prism 1B fabricated by the prism object of the cross-section sector which the angle which Fields 2a and 2b make is 60 degrees, and makes Field c the spherical surface which is a lens side shall be used. In addition, other composition is constituted like the gestalt 1 of the above-mentioned implementation. Prism 1B by the gestalt 5 of this operation is considered to be the synthetic body of prism 1a fabricated by the prism object of a cross-section equilateral triangle, and prism 1b by which the inside by the side of prism 1a is a flat surface, and superficies were fabricated by the spherical surface as shown in drawing 6. Then, according to the camera 102 of the gestalt 5 of this operation, like the gestalt 4 of the above-mentioned implementation, generating of color bleeding can be prevented and a high-definition image is obtained by prism 1a. Furthermore, since prism 1b has a lens function, the image formation lens 3 can be simplified or omitted. Moreover, even if it applies the camera by the gestalt 5 of this operation to the peripheral-vision private seal equipment for vehicles, the same effect as the gestalt 1 of the above-mentioned implementation is acquired.

[0027] gestalt 6. of operation -- the gestalt 6 of this operation specifies the refractive index of the \*\* material of prism 1A fabricated by the prism object of the cross-section equilateral triangle in the gestalt 4 of the above-mentioned implementation. That is, after extraneous light 5b from the left penetrates field 2b of prism 1A after extraneous light 5a from the right penetrates field 2a of prism 1A so that the incident angle to field 2b may turn into more than a critical angle and, the refractive index of \*\* material is prescribed that the incident angle to field 2a turns into more than a critical angle. According to the gestalt 6 of this operation, since total reflection of the extraneous lights 5a and 5b is carried out in respect of 2b and 2a, respectively, incidence can be carried out to the image formation lens 3, without losing the quantity of light of extraneous lights 5a and 5b, and a high-definition image is obtained. Moreover, if the camera by the gestalt 6 of this operation is applied to the peripheral-vision private seal equipment for vehicles, since a high-definition monitor TV picture will be acquired, it becomes easier for an operator to recognize the situation of a dead angle.

[0028] Here, the refractive index  $N$  of the \*\* material from which the incident angle to field 2a turns into more than a critical angle is explained based on drawing 7. The refraction in field 2c of prism 1A is expressed by the formula (1) by the theorem of Snell (Snell). It is an incident angle [ as opposed to / this time / as opposed to / the field angle (half size) of the image formation lens 3 / in theta ] field 2c in theta 1 / . Then, the incident angle to field 2b of prism 1 is set to 60 degree-theta1, and the conditions which carry out total reflection by field 2b are expressed with a formula (2). Therefore, a formula (3) is obtained from a formula (1) and a formula (2). Then, what is necessary is just to produce prism 1A using the \*\* material of a refractive index which satisfies a formula (3).

$N \cdot \sin \theta_1 = \sin \theta_2$  (1)

60 degree-theta1  $\geq \sin^{-1} (1/N)$  (2)

60 degree- $\sin^{-1} (\sin \theta_2 / N) \geq \sin^{-1} (1/N)$  (3)

However, theta : Field angle of an image formation lens (half size)

$N$  : -- refractive-index theta1: of the \*\* material of prism -- the incident angle to field 2c of prism -- here, the refractive index  $N$  of 30 degrees, then prism 1A should just be 1.52753 or more about the field angle theta of the image formation lens 3 as an example

[0029] In addition, with the gestalt 6 of the above-mentioned implementation, although prism 1A in the gestalt 4 of the above-mentioned implementation is explained, when the image pick-up field angle which compounded prism 1b which is the lens component of prism 1B [ in / the gestalt 5 of the above-mentioned implementation / for theta (field angle of an image formation lens) in an above-mentioned formula (3) ], and the image formation lens 3 is considered, it turns out that it is applicable also to the gestalt 5 of the above-mentioned implementation.

[0030] gestalt 7. of operation -- as shown in drawing 8, prism 1 shall consist of gestalten 7 of this operation in a tank 4 and one In addition, other composition is constituted like the gestalt 1 of the above-mentioned implementation.

[0031] Thus, since prism 1 is constituted by a tank 4 and one, as for the constituted camera 103, the miniaturization of equipment is attained. Moreover, if the camera 103 by the gestalt 7 of this operation is applied to the peripheral-vision private seal equipment for vehicles, capacity of a tank 4 can be made small and the miniaturization of the part equipment can be attained.

[0032] In addition, although prism 1 shall be constituted from a gestalt 7 of the above-mentioned implementation in a tank 4 and one in the gestalt 1 of operation, you may apply to the gestalt of other operations.

[0033] gestalt 8. of operation -- with the gestalt 8 of this operation, as shown in drawing 9, a boundary line 19 is displayed on the boundary of right picture 8a of a picture and left picture 8b which are displayed on a monitor TV 8 In addition, the camera carried in vehicles shall use either of the cameras in the gestalt of each above-mentioned implementation. And the signal of a line is added and it is made to output on a video signal on a camera circuit as a means to display a boundary line 19, with the gestalt 8 of this operation. Therefore, the peripheral-vision private seal equipment for vehicles with which a legible picture is acquired by the operator is obtained.

[0034] In addition, although the signal of a line is added and it is made to output on a video signal on a camera circuit as a means to display a boundary line 19, with the gestalt 8 of the above-mentioned implementation, the signal of a line may be added on the circuit of a monitor TV 8, and a line may be drawn on the screen of a monitor TV 8.

[0035] With the gestalt 9 of this operation, although the signal of a line is added and it is made to output on a video signal on a camera circuit as a means to display a boundary line 19, with the gestalt 8 of the gestalt 9. above-mentioned implementation of operation, as shown in drawing 10, the arris part of prism 1A should be beveled and Japanese ink 15 shall be applied to the chamfer 14 as a shading member. Since image formation of the image of a chamfer 14 is carried out on the image pick-up element 13 with the handstand mirror image by the extraneous lights 5a and 5b from a longitudinal direction, a boundary line 19 is expressed on the boundary of right picture 8a of a monitor TV 8, and left picture 8b as the gestalt 9 of this operation. Therefore, also in the camera by the gestalt 9 of this operation, the same effect as the gestalt 8 of the above-mentioned implementation is acquired. Moreover, if the camera by the gestalt 9 of this operation is applied to the peripheral-vision private seal equipment for vehicles, a boundary line 19 will be displayed between the pictures of the right and left displayed on a monitor TV screen, and it will become easy for an operator to recognize the situation of a dead angle by \*\*.

[0036] In addition, with the gestalt of each above-mentioned implementation, right-and-left reversal of the picture signal of the mirror image by which image formation was carried out on the image pick-up side of the image pick-up element 13 shall be carried out using a mirror image CCD as an image pick-up element 13, and it shall change and output to the picture signal of a normal image. However, the data-processing circuit which carries out the right-and-left reversal process of the mirror image monitor TV which right and left of a picture reverse, or the picture signal that what is necessary is just what carries out right-and-left reversal not only of the mirror image CCD but the picture signal as a neologism conversion means to carry out right-and-left reversal of the picture signal of a mirror image, and to change into the picture signal of a normal image can be used. Furthermore, an operator makes it reflect in a mirror and



may be made to observe the screen of the usual monitor TV.

[0037] Moreover, the form of each above-mentioned implementation explains as what carries out image formation of the handstand mirror image by the extraneous lights 5a and 5b which carry out incidence to a tank 4 from a longitudinal direction to the right and left on the image pck-up side of the image pck-up element 13 simultaneously. However, the extraneous light for carrying out image formation of the camera of this application on the image pck-up side of the image pck-up element 13 is not limited to the light which carries out incidence to a tank 4 from a longitudinal direction, and can carry out image formation of the handstand mirror image by the extraneous light which carries out incidence from the 2-way which faces on both sides of a tank 4 simultaneously on the image pck-up element 13 by one reflection by changing the posture of a camera.

[0038]

[Effect of the Invention] Since this invention is constituted as mentioned above, it does so an effect which is indicated below.

[0039] Housing with which the entrance window which takes in an extraneous light, respectively was prepared in both sides according to this invention, While reflecting once the extraneous light which carries out incidence from the image pck-up element arranged in this housing, and the entrance window of an unilateral and carrying out image formation of the handstand mirror image by this extraneous light to the field by the side of the entrance window of this unilateral of the image pck-up side of this image pck-up element Since the extraneous light which carries out incidence from the entrance window of the side else was reflected once and the field by the side of the entrance window of the side other than [ this ] the image pck-up side of this image pck-up element is equipped with the optical element which carries out image formation of the handstand mirror image by this extraneous light, reflection of an extraneous light becomes only 1 time, simplification of composition is attained, and a small and cheap camera is obtained.

[0040] Moreover, the image formation lens which the above-mentioned optical element is arranged by the preceding paragraph of the above-mentioned image pck-up element, and carries out image formation of the extraneous light on the image pck-up side of this image pck-up element, Since it consists of prism with which the cross-section configuration was fabricated by the prism object of two equilateral triangles, made two bisectrices of the vertical angle of these two equilateral triangles in agreement with the optical axis of this image formation lens, and was arranged by the preceding paragraph of this image formation lens, simplification of the composition of an optical element is attained. Moreover, since the field where the above-mentioned prism consists of bases of cross-section 2 equilateral triangle is formed in the lens side, simplification of an image formation lens is attained. Moreover, since the vertical angle of cross-section 2 equilateral triangle is constituted by 60 degrees, generating of color bleeding is suppressed and, as for the above-mentioned prism, a high-definition picture is acquired. Moreover, since the above-mentioned prism has the refractive index N specified by the lower formula (3), there is no loss of the quantity of light of an extraneous light, and a high-definition picture is acquired.

$60 \text{ degree-Sin-1} \{ \text{Sin}(\theta/N) \} \geq \text{Sin-1} (1/N)$  Formula (3)

(However, theta is an image pck-up field angle (half size))

Moreover, since the one-way mirror coat is given to the 2nd page which faces across the vertex of cross-section 2 equilateral triangle of the above-mentioned prism, \*\* material with a low refractive index can be used for the material of prism, and the part low-cost-ization is attained. Moreover, since the field which one is constituted by the above-mentioned housing and consists of two sides which face across the vertex of two equilateral triangles of this prism was made for the above-mentioned prism to function as the above-mentioned entrance window, respectively, the miniaturization of equipment is attained. Moreover, the boundary line between the pictures by which image formation is carried out to the image pck-up side of an image pck-up element is obtained, without carrying out special signal processing, since the above-mentioned prism is formed in the arris part which a chamfer constitutes from a vertex of two equilateral triangles and the shading member is prepared in this chamfer. Moreover, since the above-mentioned optical element consists of an image formation lens which is arranged by the preceding paragraph of the above-mentioned image pck-up element, and carries out image formation of the extraneous light on the image pck-up side of this image pck-up element, and a one-way mirror of the couple which made the predetermined angle mutually in the preceding paragraph of this image formation lens, and was symmetrically arranged to the optical axis of this image formation lens, simplification of the composition of an optical element is attained and low-cost-ization is attained further.

[0041] Housing with which the entrance window which according to this invention is attached in the anterior part of vehicles and takes in an extraneous light on both sides of right and left of the travelling direction of these vehicles, respectively was prepared, While reflecting once the extraneous light which carries out incidence of the image pck-up side from the image pck-up element arranged so that it might face at the front side of these vehicles, and a left-hand side entrance window in this housing and carrying out image formation of the handstand mirror image by this

extraneous light to the field on the left-hand side of the image pick-up side of this image pick-up element. The optical element which reflects once the extraneous light which carries out incidence from a right-hand side entrance window, and carries out image formation of the handstand mirror image by this extraneous light to the field on the right-hand side of the image pick-up side of this image pick-up element. Since it has a signal transformation means to carry out right-and-left reversal of the picture signal of the handstand mirror image by which image formation was carried out to this image pick-up side, and to change into the picture signal of a handstand normal image, and a display means to input the picture signal of the handstand normal image from this signal transformation means, and to display an erect normal image. The erect normal image by the extraneous light from the right is displayed on the right screen of a display means, and the erect normal image by the extraneous light from the left is displayed on a left screen. The peripheral-vision private seal equipment for vehicles of the screen where the direction of a screen display is legible to the operator who was in agreement with the direction of incidence of an extraneous light is obtained.

[0042] Moreover, the image formation lens which the above-mentioned optical element is arranged by the preceding paragraph of the above-mentioned image pick-up element, and carries out image formation of the extraneous light on the image pick-up side of this image pick-up element. Since it consists of prism with which the cross-section configuration was fabricated by the prism object of two equilateral triangles, made two bisectrices of the vertical angle of these two equilateral triangles in agreement with the optical axis of this image formation lens, and was arranged by the preceding paragraph of this image formation lens, simplification of the composition of an optical element is attained. Moreover, since the field which consists of bases of cross-section 2 equilateral triangle is formed in the lens side, simplification or simplification of an image formation lens is attained, and the part miniaturization of the above-mentioned prism is attained. Moreover, the high-definition image display which generating of color bleeding is suppressed and is easy to recognize the above-mentioned prism to an operator since the vertical angle of cross-section 2 equilateral triangle is constituted by 60 degrees is obtained. Moreover, the high-definition image display which loss of the quantity of light of an extraneous light is lost, and is easy to recognize to an operator since the above-mentioned prism has the refractive index  $N$  specified by the lower formula (3) is obtained.

$60 \text{ degree} - \sin^{-1} \{ \sin(\theta/N) \} \geq \sin^{-1} (1/N)$  Formula (3)

(However,  $\theta$  is an image pick-up field angle (half size))

Moreover, since the one-way mirror coat is given to the 2nd page which faces across the vertex of cross-section 2 equilateral triangle of the following prism, \*\* material with a low refractive index can be used for the material of prism, and the part low-cost-ization is attained. Moreover, since the field which one is constituted by the above-mentioned housing and consists of two sides which face across the vertex of two equilateral triangles of this prism was made for the above-mentioned prism to function as the above-mentioned entrance window, respectively, the miniaturization of equipment is attained. Moreover, since the above-mentioned prism is formed in the arris part which a chamfer constitutes from a vertex of two equilateral triangles and the shading member is prepared in this chamfer, the boundary line between the pictures by which image formation is carried out is displayed on the image pick-up side of an image pick-up element, without performing special signal processing, and legible image display is got by the operator. Moreover, since the above-mentioned optical element consists of an image formation lens which is arranged by the preceding paragraph of the above-mentioned image pick-up element, and carries out image formation of the extraneous light on the image pick-up side of this image pick-up element, and a one-way mirror of the couple which made the predetermined angle mutually in the preceding paragraph of this image formation lens, and was symmetrically arranged to the optical axis of this image formation lens, simplification of the composition of an optical element is attained. Moreover, since the above-mentioned image pick-up element carries out right-and-left reversal, it is made to output the picture signal of the handstand mirror image by which image formation was carried out to an image pick-up side and it has a function as a signal transformation means, it is not necessary to establish a special signal transformation means, and a miniaturization and low-cost-izing of equipment are attained.

---

[Translation done.]

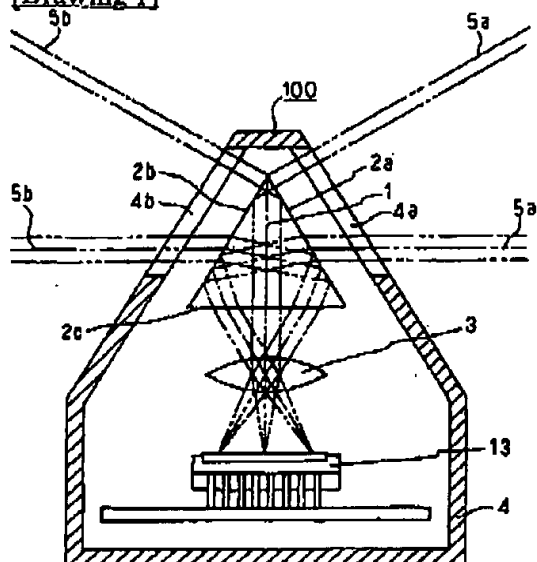
## \* NOTICES \*

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

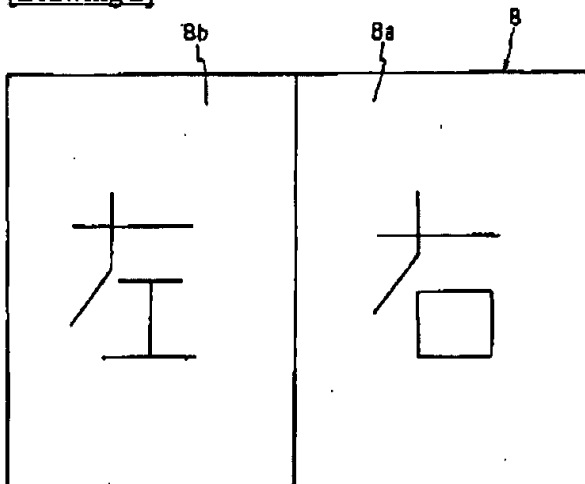
## DRAWINGS

[Drawing 1]



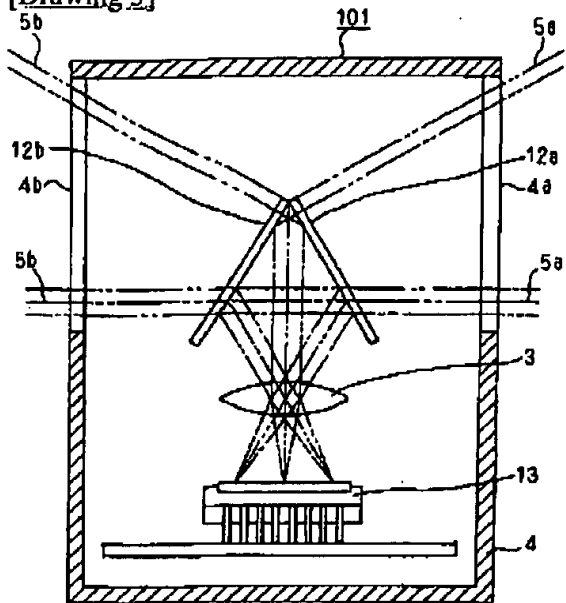
- 1: プリズム(光学素子)  
 3: 撮像レンズ(光学素子)  
 4: 外箱(ハウジング)  
 4a, 4b: 入射窓  
 5a, 5b: 外部光  
 13: 撮像素子  
 100: カメラ

[Drawing 2]



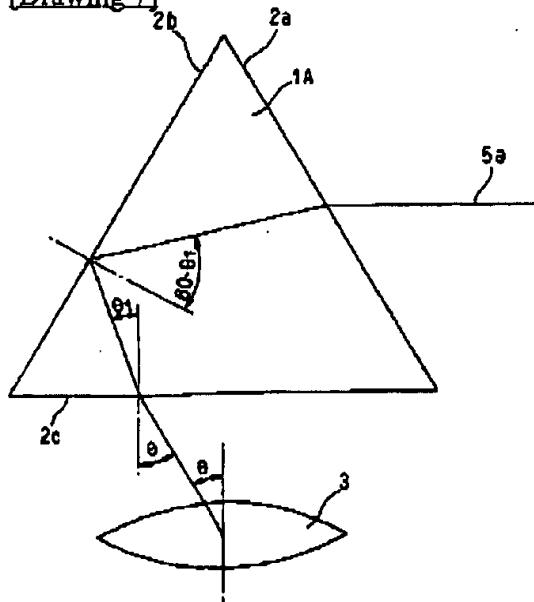
8: モニタテレビ(表示手段)

[Drawing 3]

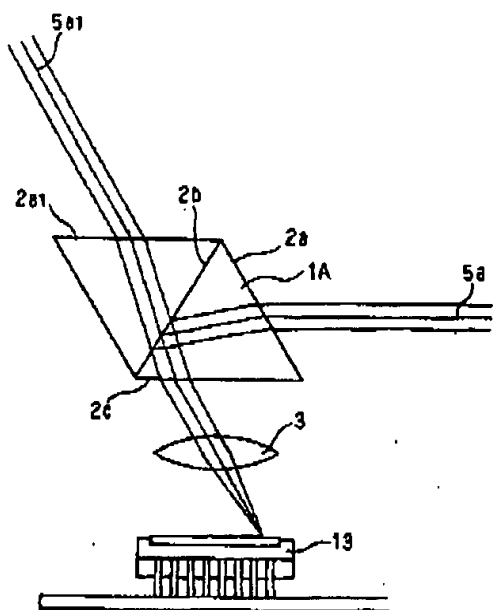


12a, 12b: ハーフミラー (光学素子)  
101: カメラ

[Drawing 7]

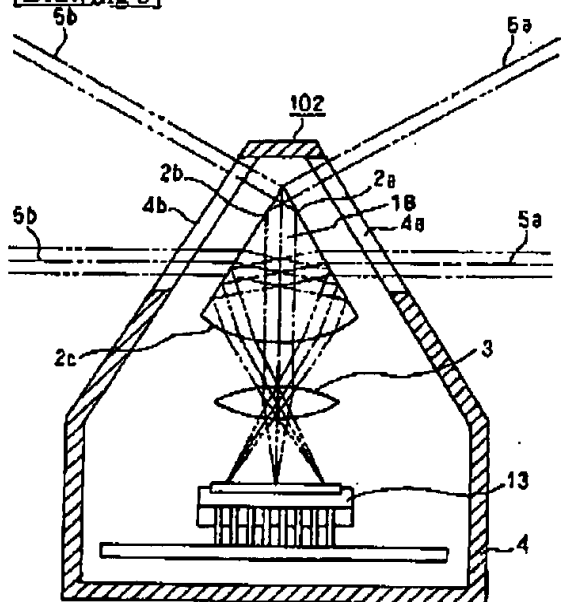


[Drawing 4]

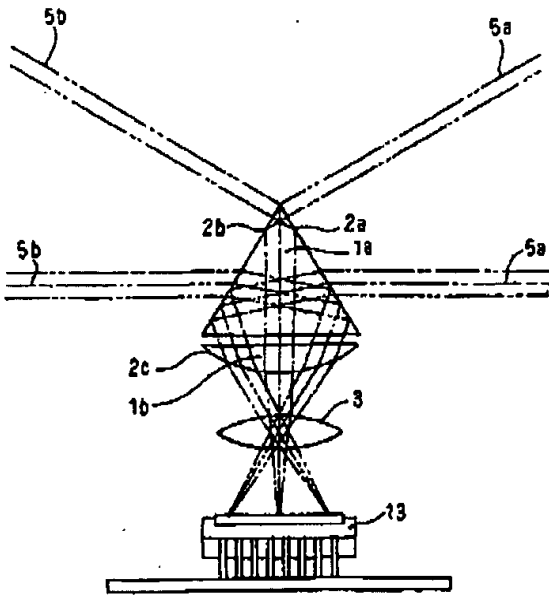


1A: プリズム (光学素子)

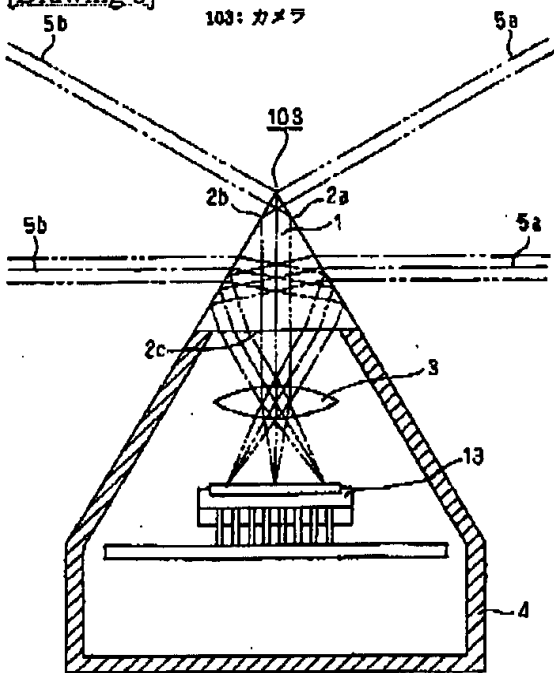
[Drawing 5]

1B: プリズム (光学素子)  
102: カメラ

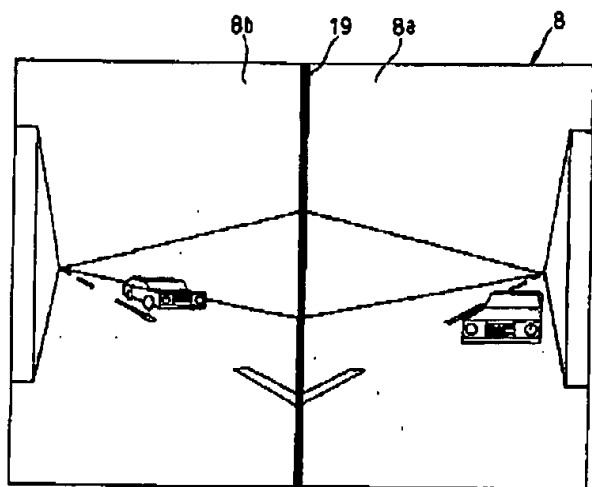
[Drawing 6]



[Drawing 8]

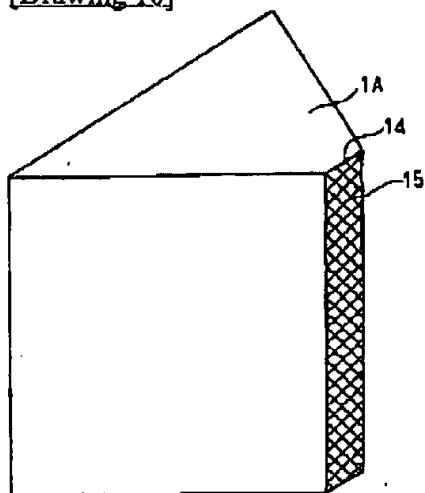


[Drawing 9]



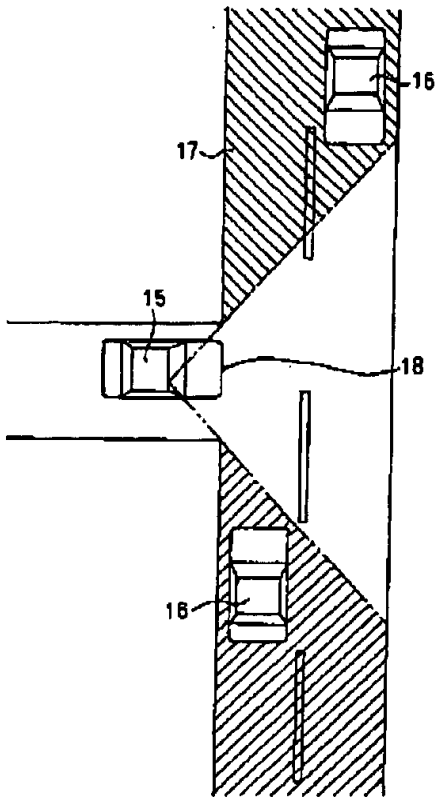
10: 境界線

[Drawing 10]

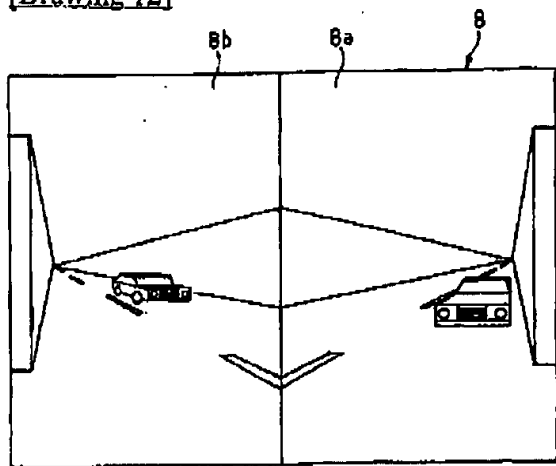


14: 面取り部  
15: 壁(透光部材)

[Drawing 11]

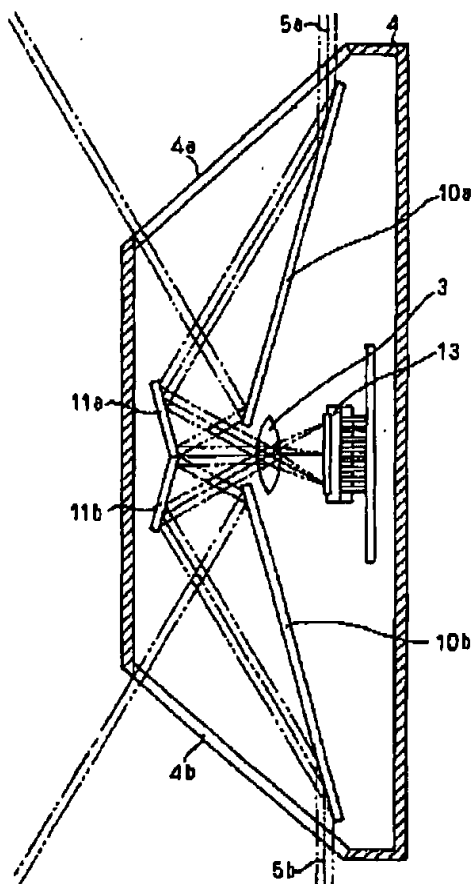


[Drawing 12]

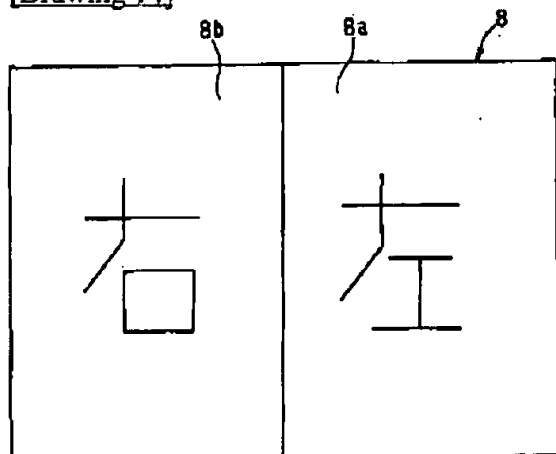


[Drawing 13]

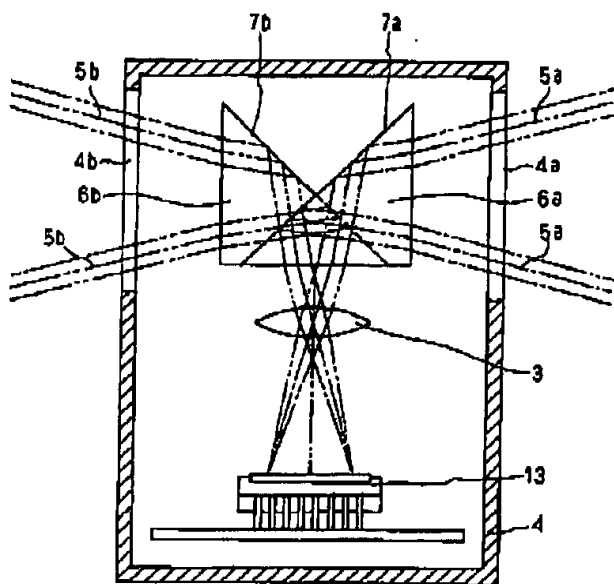




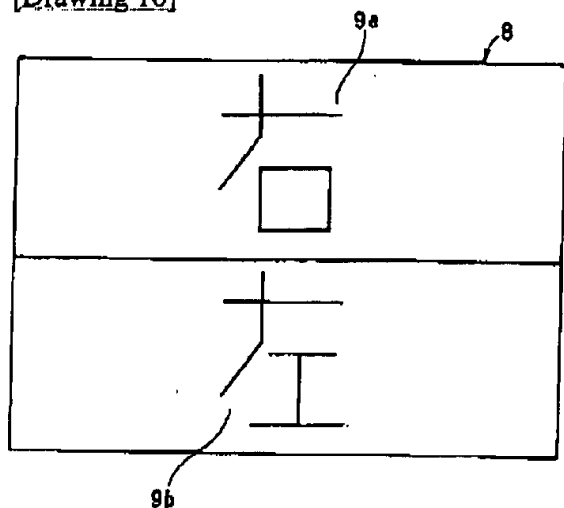
[Drawing 14]



[Drawing 15]



[Drawing 16]



[Translation done.]